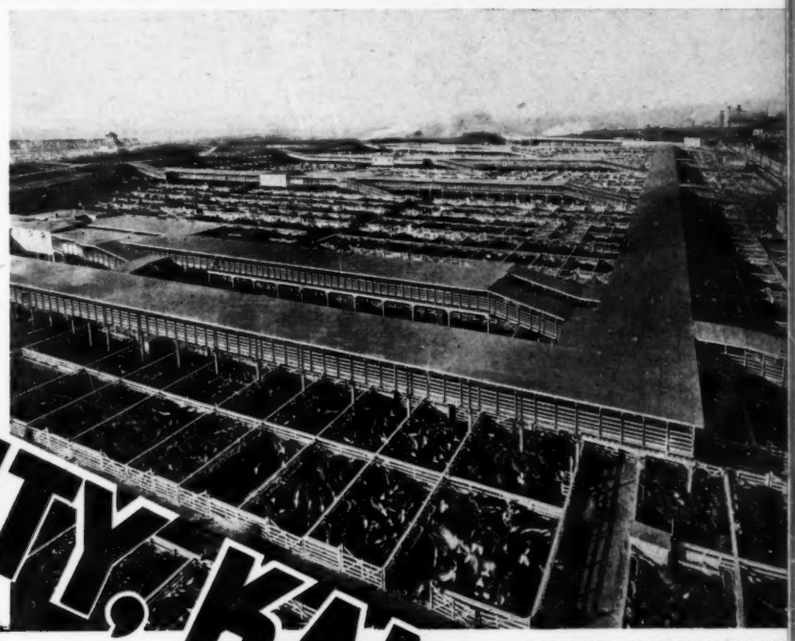
WATER WORKS & SEWERAGE

October, 1936 — Editor — Volume 83. No. 10

IN KANSAS CITY, KANSAS



A TYPICAL KANSAS CITY, KA
STOCK YAR

Founded on the site of a key encampment of the original Lewis and Clark Expedition, Kansas City, the largest city in the state, is the gateway to the Great Southwest. Historically the city has many interesting legends and facts. The main business district was the reservation of the Wyandotte and Shawnee Indians a hundred years ago. The cemetery laid out by them must remain, according to stipulation, "until the rains stop falling and the river flowing."

Kansas City, Kansas, is chiefly an industrial community, sixty per cent of its industrial output being represented in packing house products. It ranks second in the United States as a meat packing center; third in the production of soap; third in grain storage capacity and fifth as a milling center. Other important industries include structural steel, American walnut, lumber, cattle serum and caskets.

Its well managed water department provides a high quality of palatable water, which is constantly supervised by a corps of trained technicians. With the system 100% metered, water rates are based on the total consumption of each service. For years Kansas City, Kansas, has been a user of Pittsburgh Water Meters to help protect the investment it has in its water works.

PITTSBURGH EQUITABLE METER CO
MERCO NORDSTROM VALVE CO.
MAIN OFFICES PITTSBURGH, PA.

PITTSBURGH WATER METERS

ABC DESIGN · CONSTRUCTION · COLLECTION
TREATMENT · DISTRIBUTION · DISPOSAL ABP

U.S. cast iron PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

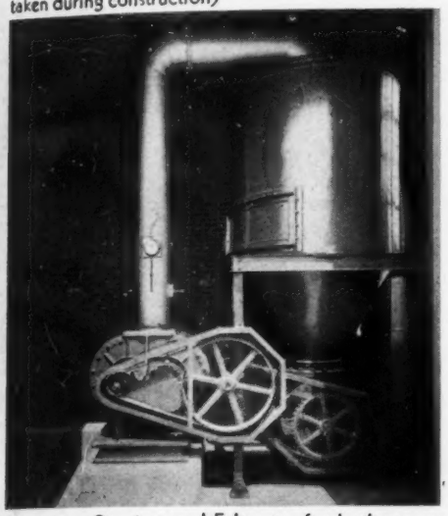
U. S. PIPE & FOUNDRY CO.
BURLINGTON, NEW JERSEY
Foundries and Sales Offices throughout the U. S.

ALL INDICATIONS point to a building boom based on low-cost housing. This will necessitate revamping or extensions to transportation lines for water, gas and sewage. Fundamental economy in such construction rests upon the choice of pipe material. While cast iron pipe may involve slightly higher first cost the ultimate cost based on years of service and freedom from maintenance is lower than that of any other material suitable for the purpose. If it is U. S. Super-de Lavaud Pipe, centrifugally cast in a metal mold without chill, you know that it is a tough, ductile material with extraordinary resistance to impact, quickly available from any one of our 15 distribution points.

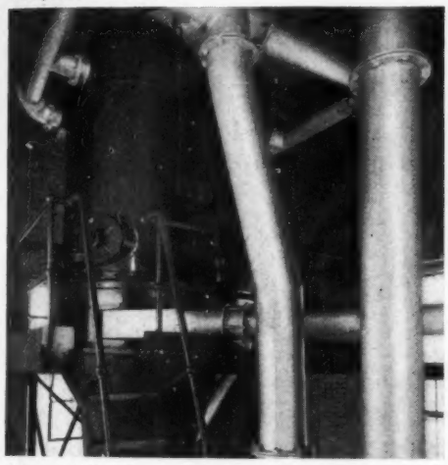
SUPER-DE LAVAUD CENTRIFUGAL CAST IRON PIPE
U. S. Pit Cast Pipe U. S. Threaded Cast Iron Pipe U. S. Mechanical Joint Pipe
U. S. Ni-Resist Cast Iron Pipe U. S. Flexible Joint Pipe U. S. Cast Iron Culverts
Alloy and Gray Iron Castings U. S. Cast Iron Roof Plates

Barge unloading dock, showing swinging boom, all-metal flexible hose and nozzle, and conveying pipe line to chlorine building. (Photo taken during construction)

And now— Coney Island *installs* The AIRVEYOR



Two-stage Receiver and Exhauster for both vacuum and pressure service.



Airveyor Filter for receiving and delivering materials to Fuller Automatic Weigh Scale, and thence to operating chemical hoppers or chemical storage bins.

AT the new Coney Island Sewage Disposal Plant, Coney Island, New York, ferric sulphate and lime will be unloaded from barges and conveyed throughout the plant by the Airveyor.

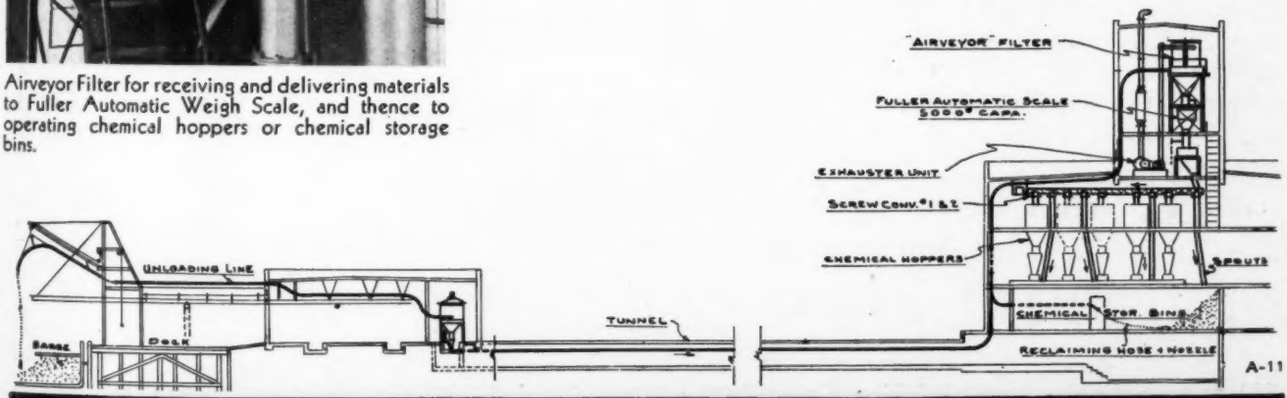
Materials will be withdrawn by vacuum from the barges to a two-stage receiver in the chlorine building, this receiver being under partial vacuum. Materials are discharged from the receiver into the pressure blowing line by means of an air-lock feeder....conveyed by combined vacuum and pressure to a filter in the chemical building for delivery through a Fuller Automatic Weigh Scale of 5000 lb. capacity.....thence to surge tanks.....and by screw conveyors and gravity to either the operating chemical hoppers direct, for immediate use, or bulk chemical storage for future use. Materials can be reclaimed by vacuum from bulk chemical storage for return to chemical hoppers when required.

The Airveyor has many outstanding advantages for conveying fine, crushed, and granular materials, among which are: speed of operation; no contamination of materials as the system can be readily cleaned; no dust nuisance, therefore, a clean plant. Available in a wide range of types and capacities.

FULLER COMPANY

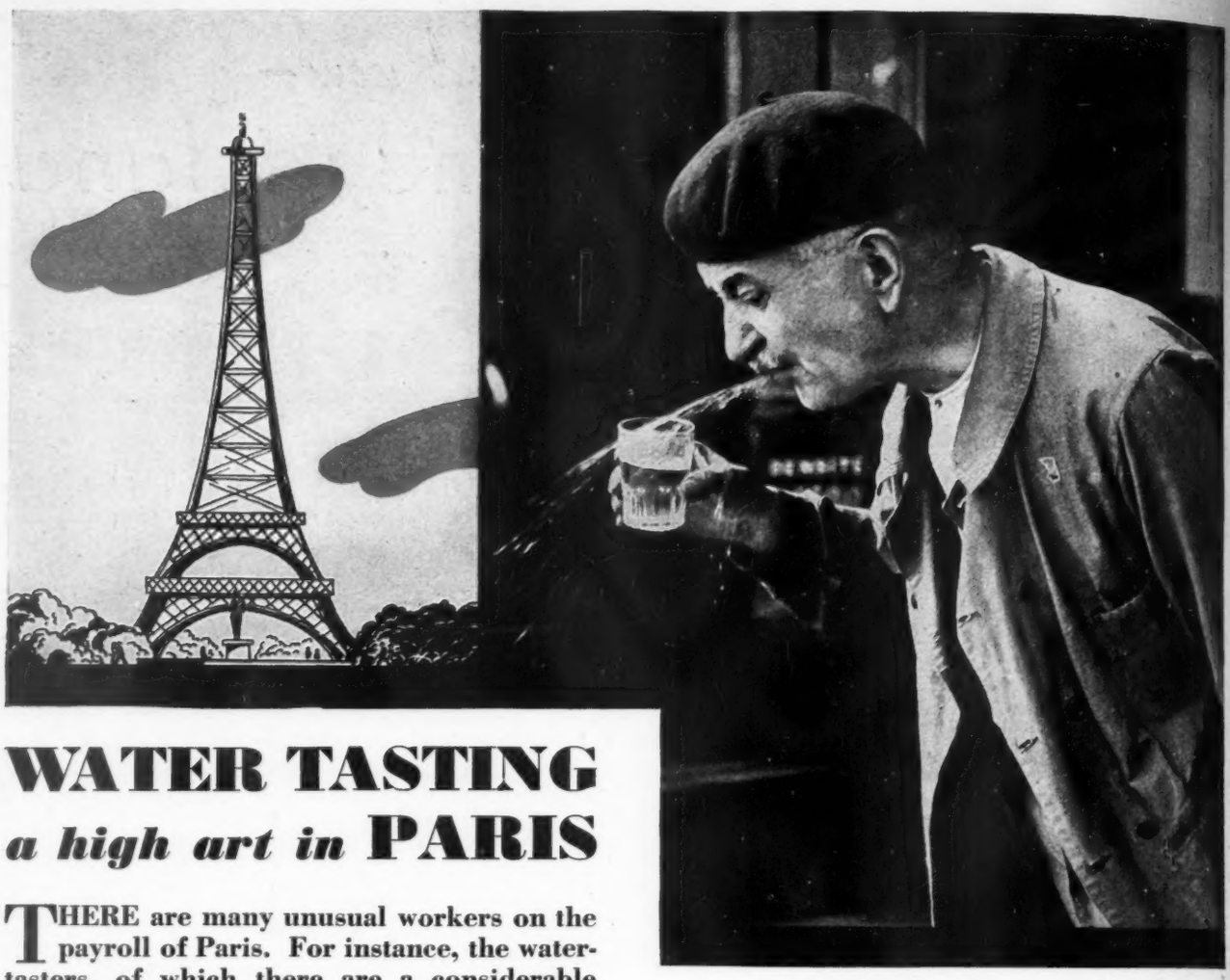
CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.



FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

WATER WORKS AND SEWERAGE, October, 1936, Volume 83, Number 10. Published monthly at 400 West Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1936. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.



WATER TASTING *a high art in* PARIS

THERE are many unusual workers on the payroll of Paris. For instance, the water-tasters, of which there are a considerable number who work on a 24-hour basis. They taste the water to make sure that the chlorine used to purify it hasn't left any sign of its passage. If a suspicious taste or smell is discovered in the water, its distribution is suspended until chemists analyze a sample. Water-tasters do not gain their positions except after a rigorous test. Many times they have shown that their palate for water is of the most delicate. Independently of the tasters, the city also uses living trout in aquariums fed by the arriving water supply at each reservoir, to detect the presence of chlorine in the water. Since trout are peculiarly sensitive to chlorine, they act as verifiers of the tasting, sometimes at the cost of their own lives.

Unlike our foreign neighbors, we do not have in this country professional water-tasters but every well-managed filter plant employs technically-trained chemists who are always on the alert for sudden and unexpected tastes and odors in their raw water supply—and they know THE ANSWER FOR THESE TROUBLES (AQUA NUCHAR). Most of the larger filter plants realize their responsibility to the public in furnishing palatable water at all times and to do so are feeding small dosages of AQUA NUCHAR continuously—consumers appreciat this—consumers relationship is enhanced.

PHOTO SHOWS: A WATER-TASTER RIDDING HIMSELF OF WHAT APPEARS TO BE A BAD MOUTHFUL, AT THE MONTSOURIS RESERVOIR.

E. A. Sigworth
Technical Sales Div.

STOCKS ALL OVER U. S. A.

INDUSTRIAL CHEMICAL SALES CO.

INCORPORATED

230 Park Avenue, New York
205 West Wacker Drive, Chicago, Ill.
418 Schofield Bldg., Cleveland, Ohio

5 Gates of Everdur Metal

(STRENGTHENED COPPER)

High Strength...Long Life...Light Weight and Low Cost

FIVE of these easily *hand-operated* Everdur shut-off gates were installed in the screen room of the Rahway Valley Joint Meeting Sewage Treatment Works, Rahway, N. J. They have but *one-fifth* the weight of ribbed cast-iron gates with electric drive and control.

Such strong, light weight construction is frequently possible with Everdur Metal. This non-rust, high-strength alloy possesses corrosion resistance equal to copper. It is readily workable either hot or cold, and can be welded by any of the commonly used methods —making possible fabricating economies and important savings in weight.

Long life for these Rahway Valley gates is assured by the high corrosion resistance of Everdur, and its fine record in sewage treatment service since 1927.

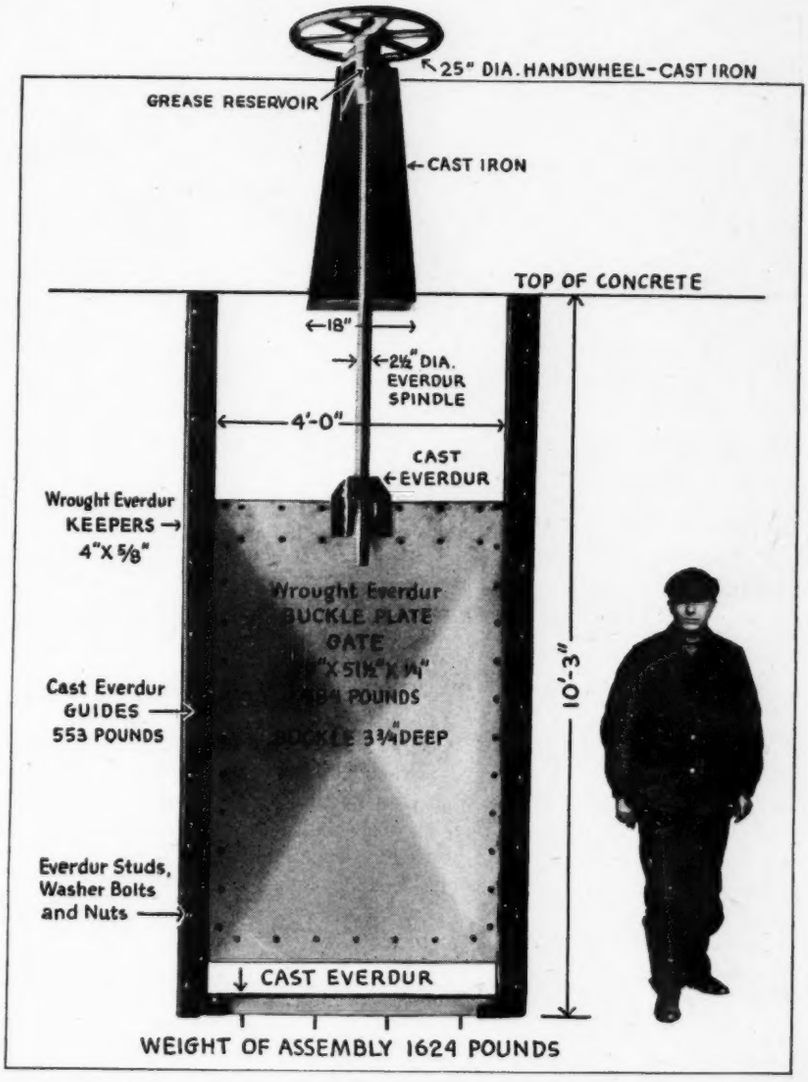
Everdur Metal is moderately priced and is available in all commercial shapes. Anaconda Publication E-11 gives the history of Everdur Metal in Sewage Treatment Equipment, Reservoir and Water Works Service. Write for it.

• • •

"EVERDUR" is a registered trade-mark identifying products of The American Brass Company made from alloys of copper, silicon and other elements.

EVERDUR IS BEING USED FOR

Coarse and Fine Screens, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gauge Chains, Valve Springs, Manhole Steps, Guides, Walkways, Bars and Plates, Bolts and Nuts.



One of the five shut-off gates ready for installation in Rahway Valley Sewage Treatment Works. Designed and built by Row Engineers, Inc., N. Y. Total weight of unit, including cast-iron stand, bearings and handwheel, is 1624 pounds.

ANACONDA from mine to consumer

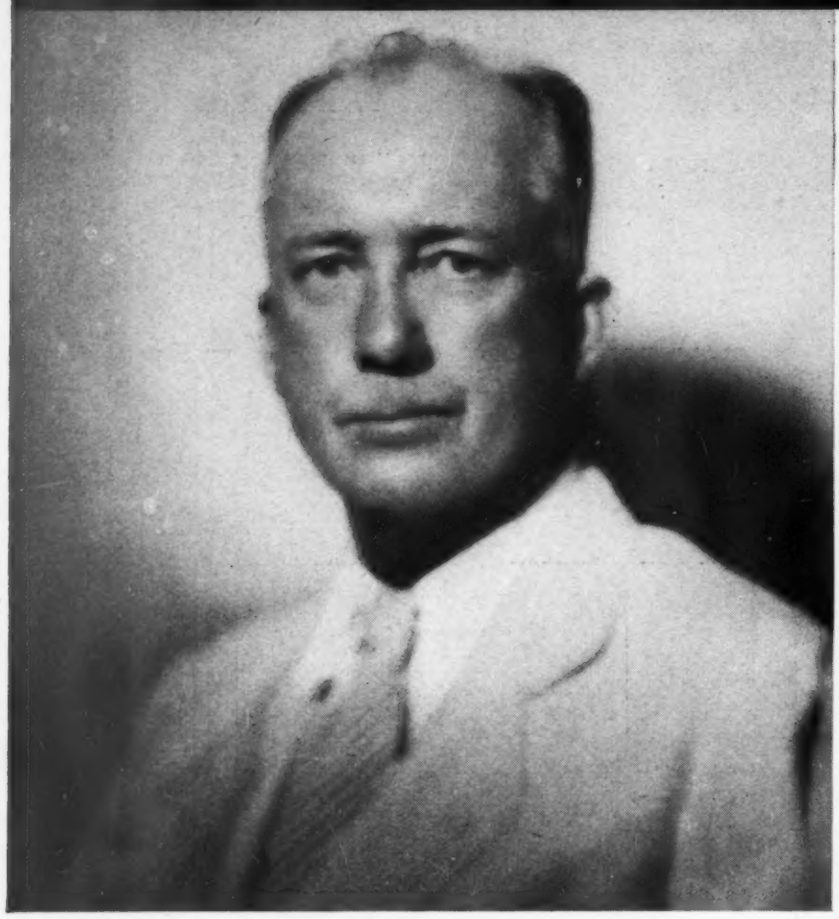
363'6

Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

Offices and Agencies in Principal Cities . . . In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

"12 YEARS OF SATISFACTION"



J. C. Martin of Tarboro, N. C., is Enthusiastic about His Experience with Mathieson Products

A FINER ideal of service than that of the modern water works man is hard to imagine. Few people indeed are charged with greater responsibility—few face more exacting demands for unfailing service. No wonder, then, that we see significance in what J. C. Martin, Superintendent of Public Works at Tarboro, N. C., has to say about Mathieson Products and Mathieson Service:

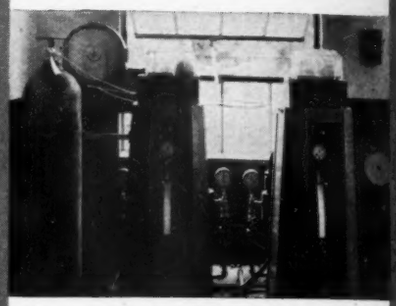
"We have used Mathieson Chlorine at our filtration plant since about 1923. Your service has always been prompt and the cylinders clean. We also use this product at our sewage disposal plant.

"We have used H T H and chlorine at our municipal swimming pool ever since its opening in the late summer of 1933. We treat the water in this 275,000-gal. pool with your chlorine and use H T H in foot baths and on locker room floors. We consider H T H particularly effective in pool hygiene work as we have not had a particle of trouble with Athlete's Foot or any other skin disease."

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street **New York, N. Y.**

Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Solid Carbon Dioxide

From an engineering standpoint—and in appearance—the new Tarboro Filtration Plant is the last word.

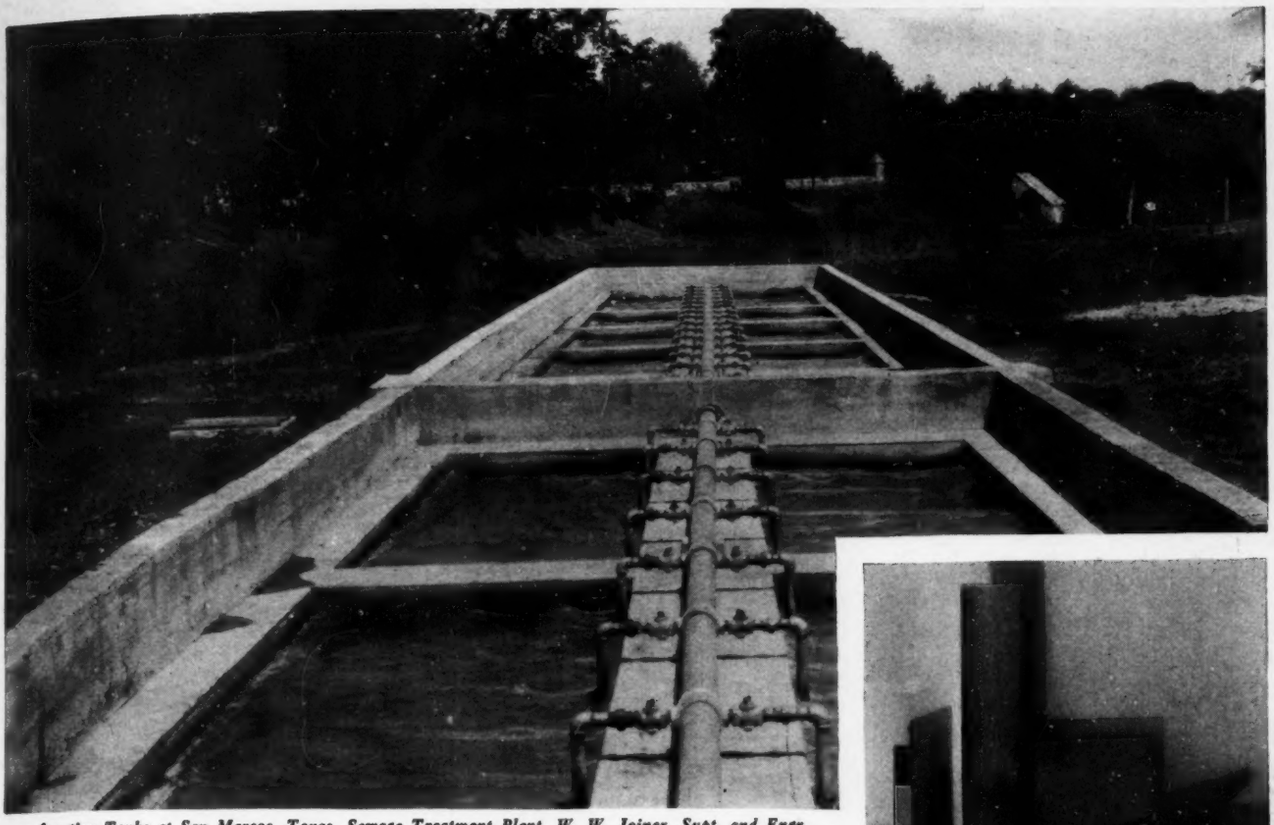


Chlorinator installation feeding Mathieson Liquid Chlorine at the Tarboro Plant.

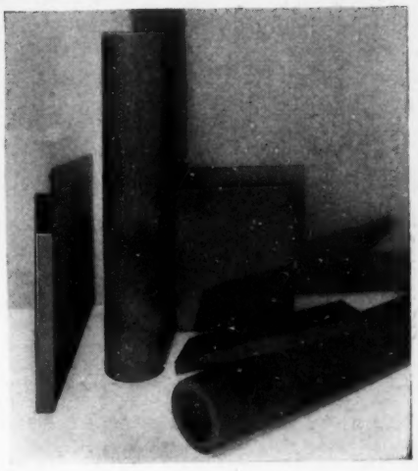
Another view of the 1,500,000 gallon Tarboro Filtration Plant, completed this year.

The attractive Tarboro Municipal Pool where Mathieson Chlorine safeguards the water and HTH guards against Athlete's Foot.

FORCEFUL FACTS ON SEWAGE AERATION BY AIR DIFFUSION—No. 10



Aeration Tanks at San Marcos, Texas, Sewage Treatment Plant, W. W. Joiner, Supt. and Engr.



Time tells!

EXPERIENCE PROVES SOUNDNESS OF ACTIVATED SLUDGE TREATMENT USING POROUS DIFFUSERS

BUILT in 1916, the San Marcos, Texas, sewage treatment plant was the first complete activated sludge plant in the United States. Air was introduced into the sewage by both porous diffuser plates and small open end iron diffuser pipes.

It was soon found that much less air was necessary to accomplish the desired result with the porous diffusers than with the open end pipe. As time went on the superior efficiency and economy of the porous plates became more and more evident. It was only natural, then, that porous diffuser plates were installed throughout when the San Marcos plant was reconstructed in 1935.

The results at this plant are typical of those obtained wherever perforated pipe has been compared with porous diffusers. 20 years' experience at San Marcos has definitely confirmed the principle that maximum efficiency of activated sludge is obtained by the diffusion of air bubbles, and that the smaller the bubbles the more efficient the treatment.

ALOXITE BRAND
REG. U. S. PAT. OFF.
DIFFUSERS

The best way to obtain the desired diffusion of small air bubbles is by the use of Aloxite Brand Diffuser Plates and Tubes. Developed through long years of research, their uniform porous structure assures perfect diffusion and produces the smallest possible bubbles for a given permeability rating. This is accomplished without increasing the pressure loss through the diffuser. Our engineers will gladly discuss the use of these products in your own plant.

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of The Carborundum Company)

HOW TO HANDLE IT IF IT IS SCREENINGS

The Rex Triturator brings new advantages to shredding sewage screenings . . . .

● The Rex Triturator* now provides the ideal means of disposal for sewage screenings. Installed either with new or existing bar racks (hand or mechanically cleaned), it provides all the advantages of complete screenings disposal within the system. Its clean-cut shearing action of 350,000 blade cuts per minute completely disintegrates rags, papers and all forms of organic solids. The residue is returned to the sewage flow and becomes additional primary sludge.

The work is done with very low water and very low power consumption.

The Rex Triturator is a substantially built unit. It consists essentially of a toothed rotor revolving at high speed between two grates with the cutting teeth intermeshing the grate bars. Pivoting of the grates under heavy spring pressure provides for yielding of the grates under excessive loading, allowing the passage of tramp material without severe damage to the machine.

The Rex Triturator is new in design, appearance, operating principle and performance. Its capacity is large, operation simple, and power and maintenance cost low.

A new bulletin on this new addition to Rex Sanitation Equipment is now ready. Send today for your copy of The Rex Triturator Catalog.

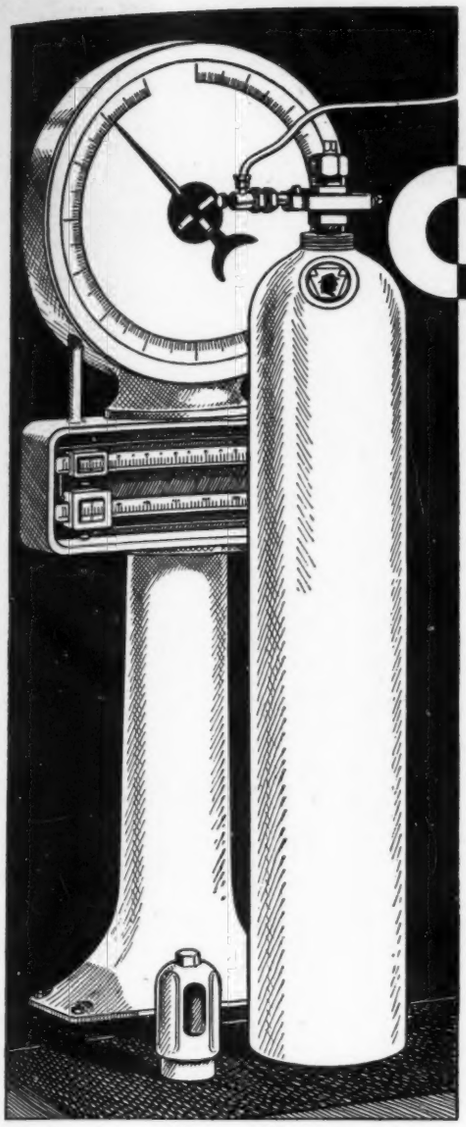
CHAIN BELT COMPANY
1610 W. Bruce St., Milwaukee, Wis.

*Webster's Dictionary: Triturate — to comminute thoroughly.

REX

CHAIN BELT COMPANY
of MILWAUKEE

Sanitation Equipment



CHLORINE
OF HIGH PURITY

IN preparation of Liquid Chlorine for use in water purification and sewage treatment, meticulous care is taken to provide only gas of the highest purity. Liquid Chlorine produced by the Pennsylvania Salt Manufacturing Company is exceedingly pure — this factor is given closest attention during manufacture — and its uniform high quality is based upon eighty-six years' experience in the production of chemicals for industry.

Quick deliveries to all sections of the country are assured by the convenient locations of our plants.

Specialized technical service is immediately available without cost, to adapt our products to your specific requirements.

●

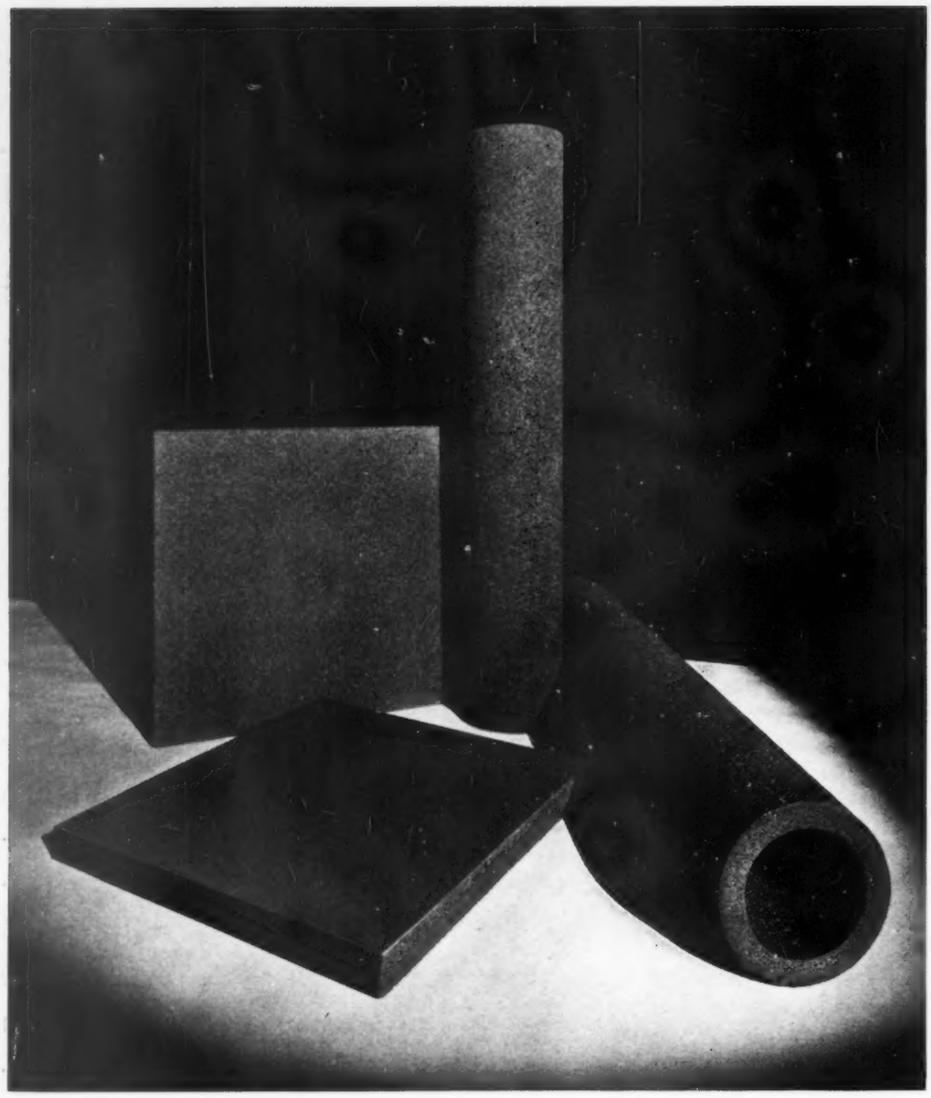
Among the dependable and uniform quality products produced by this company are:

PERCHLORON
CHLORINE
AMMONIA
FERRIC CHLORIDE
ALUM

EST. 1850 TRADE MARK

PENNSYLVANIA
SALT MANUFACTURING COMPANY
EXECUTIVE OFFICES, WIDENER BLDG., PHILADELPHIA, PA.

BRANCH SALES OFFICES: NEW YORK · CHICAGO · ST. LOUIS · PITTSBURGH · TACOMA · WYANDOTTE



The Favorite Choice of Many Sewerage Works Engineers

NORTON COMPANY
Worcester, Mass.
New York Chicago
Cleveland

UNIFORMITY and low wet-pressure loss are important reasons for the popularity of Norton Diffuser Plates and Tubes. Also, due to the physical structure of the plate and the shape of the grain, the rate of clogging is kept at a low point with the resultant saving on cleaning and the maintenance of a lower pressure loss for a longer period.

Many years of experience in the manufacture of porous products has enabled the Norton Company to build into their diffuser plates and tubes these important factors as well as other qualities which make them outstanding in their field.

R-545

NORTON POROUS MEDIUMS

COLUMBIA

FIRST TANK CAR OF COLUMBIA LIQUID CHLORINE LEAVING THE BARBERTON PLANT

LIQUID CHLORINE

Specify
COLUMBIA LIQUID CHLORINE
● Delivery in single and multiple unit tank cars..Also in 100 lb. and 150 lb. cylinders.

★ SODA ASH
★ CAUSTIC SODA
★ MODIFIED SODAS
★ CALCIUM CHLORIDE
★ AND NOW *Liquid Chlorine*

PRODUCTION of liquid chlorine in our new plant at Barberton enables us to offer users of this "temperamental" commodity that three-fold protection which buyers of other COLUMBIA products have long enjoyed:

1 • MINIMUM VARIATION
2 • MAXIMUM PURITY
3 • DEPENDABLE SERVICE

A new broom sweeps cleanest in skilled hands. Modern-day equipment . . . latest production technique . . . the know-how of chlorine application . . . the name COLUMBIA • standard of quality for 37 years • now affixed to LIQUID CHLORINE by tank car and cylinder.

THE COLUMBIA ALKALI CORPORATION

EXECUTIVE SALES OFFICES • 30 ROCKEFELLER PLAZA · NEW YORK
Branch Sales Offices • BARBERTON, OHIO • 431-451 ST. CLAIR ST., CHICAGO
CAREW TOWER, CINCINNATI • GRANT BLDG., PITTSBURGH • Plant at Barberton, Ohio

19 miles of pipe laid....with only 3 small leaks..!

"We believe we have set a RECORD"

"We believe we have set a record with the use of MINERALEAD on this project we are just finishing. NINETEEN MILES of water pipe laid and only three small leaks have shown up. We are staunch boosters of MINERALEAD and are glad to recommend it."

E. H. Reeder Constuction Co., Dallas, Texas.

LAYING a water main of any length is a job which brings its fair quota of worries. It is very satisfactory to dismiss those that so often come with jointing.

Joints permanently tight and amply flexible to meet traffic vibrations are delivered regularly by MINERALEAD.

To this add MINERALEAD's easier handling, ingot form, no waste, no damage from rain or flood, no possibility of change in composition during transit to you, no delays when fresh MINERALEAD is added to the melting pot . . . and you'll understand why *users* become *boosters.*

We'll be glad to tell you how MINERALEAD will save you time, trouble and money on that Bell and Spigot pipe-laying job you have in mind. No obligation. Write

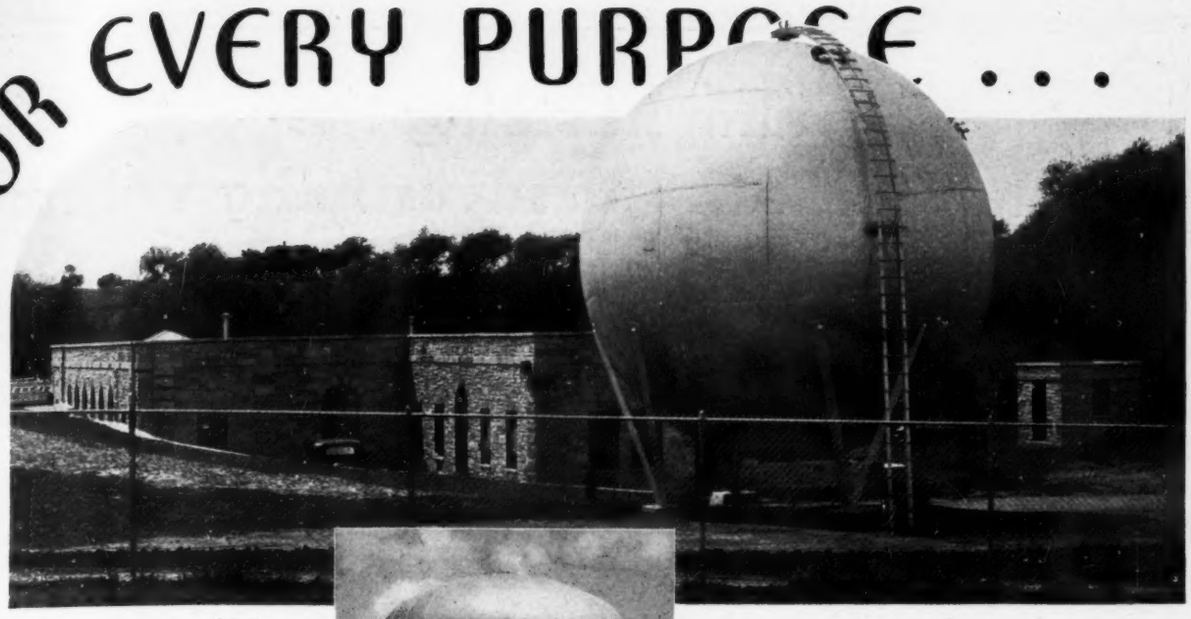
THE ATLAS MINERAL PRODUCTS COMPANY *of Pennsylvania*
MERTZTOWN • **PENNSLYVANIA**

In a Test Extraordinary, we improvised a power hammer with a 50 lb. head and, for eighteen consecutive hours, pounded a MINERALEAD joint centered in a 24′ stretch of pipe suspended only at either end. At the end of the ordeal the joint didn't leak a drop.

MINERALEAD

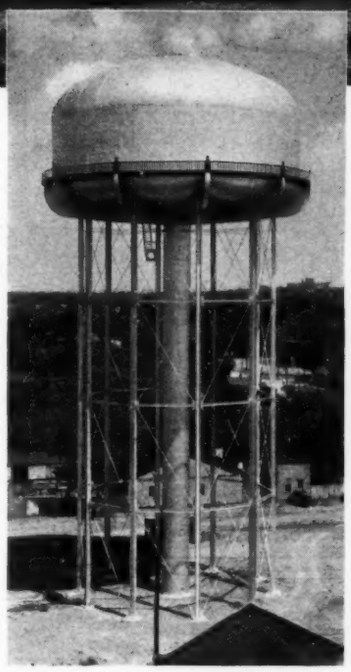
. . . . . FOR JOINTING BELL AND SPIGOT PIPE

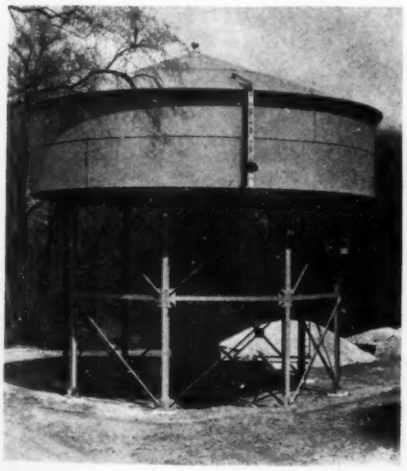
STEEL TANKS FOR EVERY PURPOSE . . .



SALINA, KANSAS, IMPROVES SERVICE

Right—With power cost averaging only 1¼ cents per kwh., it might seem that the water works department at Salina, Kansas, would have found little to be gained from the installation of the 1,000,000-gal. radial cone bottom tank, shown at the right. But such is not the case. On the contrary, Salina has found that more uniform pressures, better fire protection, and lower equipment investment make adequate elevated storage easily worth all it costs, even disregarding the usual savings in power.





SPECIALLY DESIGNED WASHWATER TANK

Left—This 125,000 gal. radial cone bottom washwater tank was especially designed to meet the requirements of the 56,000,000-gal. New Milford, N. J., filter plant of the Hackensack Water Co.

Flow for washing filter beds is easily and accurately controlled to permit any rate up to 7,000 g.p.m. with a low but uniform head. Quantity of water used in washing each of the sixteen 1,200 sq. ft. filters runs from 40,000 to 60,000 gal. Average period between washings is 18 hours.

STORING SEWAGE GAS AT 40 LBS. PRESSURE

Above—In a manner that suggests perpetual motion, sewage at Beaver Dam, Wisconsin, is fed into a digester heated by coils connected to a gas-fired boiler. As the sewage heats, it produces more gas to fire the furnace connected to the coils that heat the digester.

Important in this set-up is the 26 ft. 9 in. diameter welded Hortonsphere shown above which is used in storing the sewage gas at a pressure of 40 lbs. per sq. in. Thus, surplus gas produced in peak periods is made to carry the plant smoothly through periods when gas production is at a minimum. Water works engineers will recognize in this the same principle as is followed in using elevated water storage tanks to smooth out pumping rates. With the sphere in service, greater efficiency in incinerating processes has also been possible. That efficient utilization of sewage gas produced is worth while is indicated by the fact that the plant has worked through cold Wisconsin winters with no fuel bill whatsoever.

Here, as in other recent engineering projects, the Hortonsphere was selected because it permitted storage of a large quantity of gas with a minimum investment for equipment.

• • •

We will be glad to furnish additional information on any or all of the projects mentioned here to readers interested in possible improvements for their own cities. We are also always glad to furnish quotations on all kinds of tanks, reservoirs, penstocks, pipe, smoke stacks, standpipes, and other types of welded or riveted plate work. Address our nearest office.

CHICAGO BRIDGE & IRON WORKS

Chicago.....2198 Old Colony Bldg. Dallas.1479 Dallas Athletic Club Bldg. Houston.....2919 Main St. Boston..1548 Consolidated Gas Bldg.
New York.3390-165 Broadway Bldg. Birmingham...1586 North 50th St. Detroit.....1551 Lafayette Bldg. San Francisco....1083 Rialto Bldg.
Cleveland....2262 Rockefeller Bldg. Tulsa.....1646 Thompson Bldg. Philadelphia..1644-1700 Walnut St. Los Angeles...1455 Wm. Fox Bldg.

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

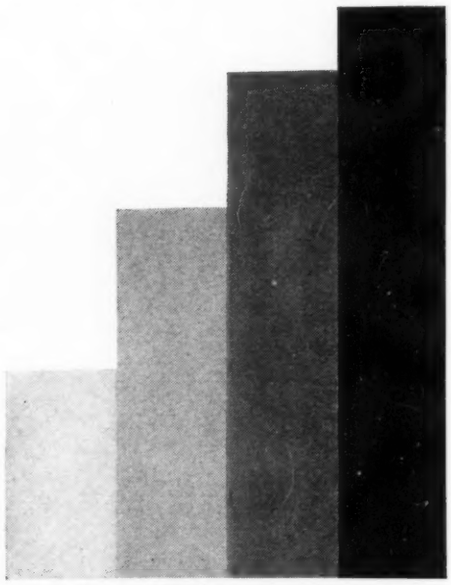
Emphasizing the Meteoric Gain in Advertising Volume of

WATER WORKS & SEWERAGE

1st 6 Months Period: 1933-1936, incl.

Percentage Increase, 4-Year Period — 284%

(September, 1936, is 25% Ahead of September, 1935)



WATER WORKS & SEWERAGE is the only magazine of National Circulation (likewise, an important foreign coverage) devoted exclusively to the two closely allied and interlocking fields: water works and sewerage.

GILLETTE PUBLISHING COMPANY

Daily News Plaza, Chicago — **155 E. 44th St., New York**

ASSURANCE IN ADVANCE
of Dependable Performance

● Responsibility for a service so vital to health and safety as water supply necessitates more than mere reliance upon acceptance tests. The experience, ability and integrity of the manufacturer are of equal importance.

Men who shoulder the responsibility of specifying extra large and special valves entrust their work to Crane Co. There they know they will obtain the benefits of experience and engineering knowledge gained over a period of 80 years.

Added to this are Crane Co.'s adequate metallurgical, testing and manufacturing facilities plus precision workmanship.

It is all these factors which give the waterworks engineer that assurance of long, dependable performance in standard and special valves which he naturally seeks before entrusting his work to any manufacturer.

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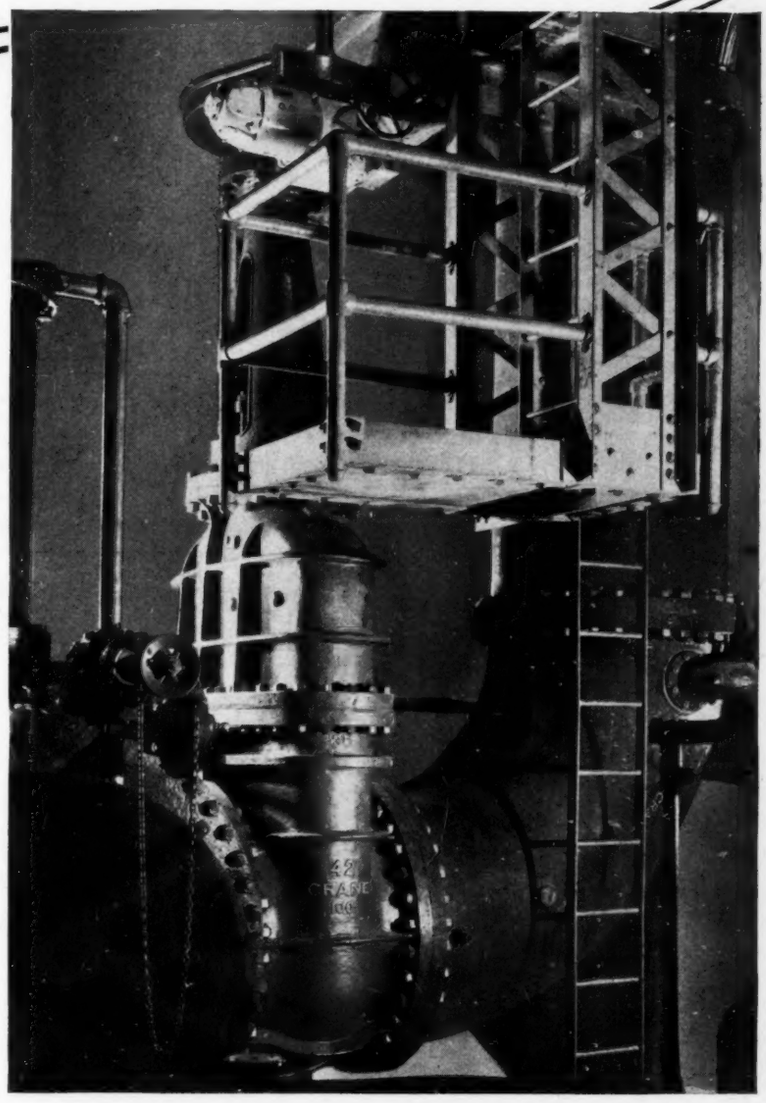

Crane 42-inch motor-operated valve on discharge side of 60-million gal. per day pump.

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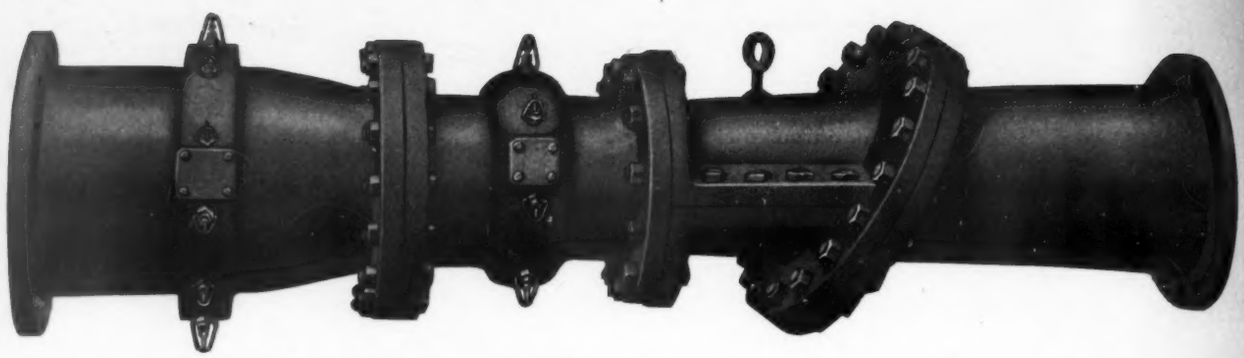


Easily cleaned, so constantly accurate!

VENTURI
"VENTURI"—Registered

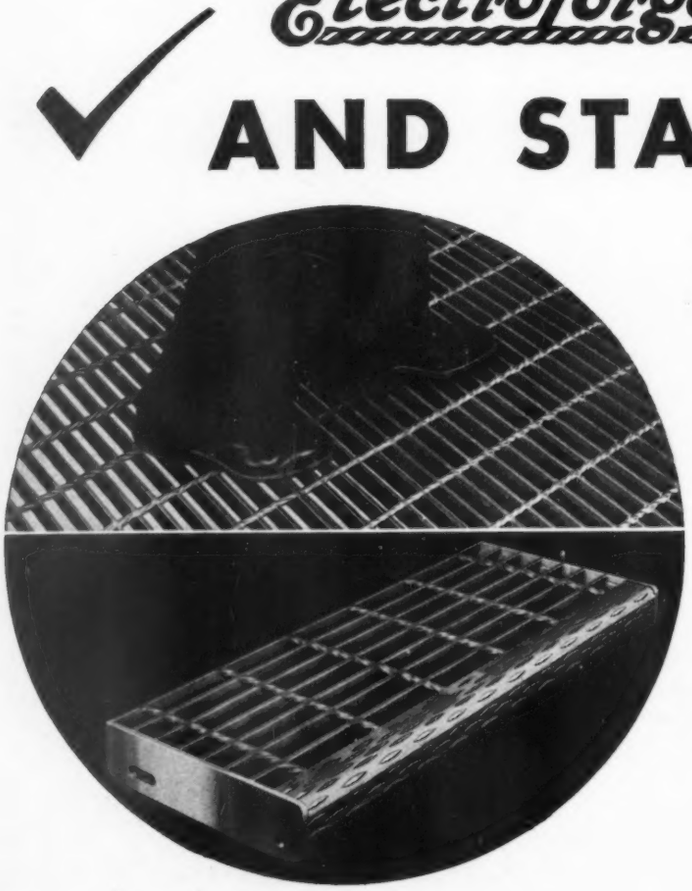
Cleanliness is next to . . . accuracy when you are measuring sewage or sludge which has a tendency to "build up" on the inside of the Venturi Tube. So, while standard Venturi Tubes are satisfactory for most sewage plant uses, Split-Section (easily cleaned) Tubes are recommended for extreme services.

Important as this device is in itself it is more important as an example of the thoroughness with which Builders Metering and Controlling Equipment has been designed to give accurate and dependable results during years of hard service.

May we submit our suggestions on your next job?

BUILDERS IRON FOUNDRY·PROVIDENCE·R·I·

✓ *Electroforged* GRATING AND STAIR TREADS



Check these practical, distinctive and outstanding features of Blaw-Knox Electroforged Steel Grating and Treads.

ONE-PIECE
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EASILY PAINTED

To help you visualize these points we have prepared a sample (paperweight size) for mailing to you. It will be sent free and without obligation—just write us asking for GRATING sample.

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CHICAGO Does 2 Things *in a Bigger and Better Way*

SELECTS MECHANICAL SLUDGE DEWATERING FOR ITS SOUTHWEST SEWAGE TREATMENT WORKS

ORDERS TWENTY-FOUR 11'6" x 16' OLIVER CONTINUOUS SLUDGE DEWATERERS FOR THE WORK

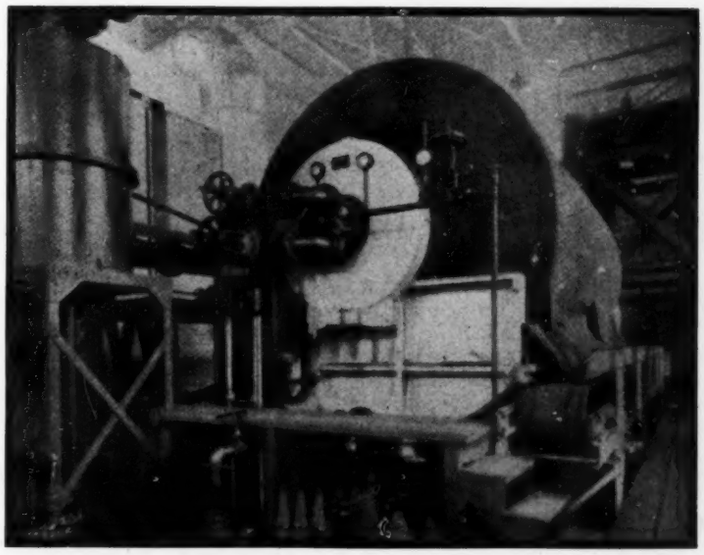
CHICAGO, a progressive city, is always seeking to do things better. And, naturally, considering its size, it does things in a big way. The twenty-four large Oliver Sludge Filters will take care of sewage from an equivalent population of 3,500,000.

In this action on the part of Chicago authorities, there is a message to other communities, regardless of size, which, if quoted, would run somewhat as follows:

"We have decided that continuous mechanical sludge dewatering is the coming method and economical and easy to operate. We have tested it out thoroughly with other Olivers. Every nuisance factor is eliminated. The sludge dewatering plant is clean and compact."

Continuous mechanical dewatering is applicable to all types of sludge, thus making it possible for practically every community to use it in connection with its modern sewage-treating system. Small communities can use our Combined Oliver Sludge Dewaterer.

Oliver United engineers—with more than ten years of experience and extensive research work—and with by far the largest number of installations—will be glad to help draw up plans. Each town or city will be assured of getting the correct filter for the work.



Oliver Continuous Sludge Dewaterer in the Southwest Sewage Treatment Works, Chicago

OLIVER UNITED FILTERS INC.

NEW YORK, N. Y. 33 West 42nd St.
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SAN FRANCISCO, CAL. 351 California St.

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IN THE DISPOSAL PLANT
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In every part of the sewage disposal plant it is good engineering judgment to use Alcoa Aluminum, because it has these properties:

1. RESISTANCE TO CORROSION: Properly selected alloys of Aluminum are not appreciably affected by the corrosive fluids, chemicals and atmospheres encountered in the disposal plant. For this reason, Alcoa Aluminum is the logical specification for screens, pipes and fittings, diffuser-plate holders, and similar applications.

2. LIGHTNESS WITH STRENGTH: Nature made Aluminum light. Research made it strong. The lightness and structural strength of Alcoa Aluminum save on installation and upkeep of such parts as distributors, sludge removers, floating covers, and other equipment.

Write us for complete information concerning the many applications of Alcoa Aluminum which make disposal plant operation cost less. ALUMINUM COMPANY OF AMERICA, 2146 Gulf Building, Pittsburgh, Pennsylvania.

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Windows
Window Hardware
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Door Hardware
Transom Frames
Electrical Conduit
Conduit Fittings
Light Fixtures
Bus Bar
Electrical Conductor Cable
Tubular Guard Railing
Tread Plates
Walkway Gratings
Trapdoors
Sidewalk Doors
Woven Fencing
Insect Screen Wire
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Office Furniture
Laboratory Equipment
Wheelbarrows
Small Tools

ALCOA ALUMINUM

WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"Kinks in Operation and Maintenance"—which are being employed successfully in the Washington Suburban Sanitary District are to be incorporated into an article by Carl A. Hechmer, Engineer of Treatment and Distribution. Those who know the author, or have read his contributions will look forward with considerable interest to his forthcoming article.

Good material here for addition to our Reference & Data Book to be revised in 1937. Suggestions and contributions to its betterment gratefully received.

Robert A. Allton, Sewerage Engineer, in charge of design and construction of Columbus' new activated sludge plant, has incorporated many novel, interesting new design and operating features in this attractively low capacity-cost plant. Mr. Allton will reveal many of these to the readers of WATER WORKS AND SEWERAGE in an unscheduled article in a coming issue—not too far removed, we hope, to justify this announcement. To get Bob Allton "penpushing" is an achievement of which we are proud. There's meat ahead for the reader.

"Pipe Line Corrosion Control"—is the subject of an article from Sheppard T. Powell, Chemical Engineer and water treatment specialist, which will supplement the revealing and thought provoking article appearing in this issue by Chas. P. Hoover, another water treatment expert. Mr. Powell's contribution will set forth the method of and results from a de-aerating (de-oxygenating) scheme on an important industrial water supply main found suffering materially from corrosion and tuberculation. Hoover believes de-oxygenation is not the answer; Powell believes it is. Read both and then read them over again; progress is being made.

"Handling Industrial Wastes at Sewage Treatment Works"—by Chas. C. Hommon, Sewerage Advisor and Superintendent, Teratment Works, Canton, O. reveals a satisfactory method adopted by a small city which enabled the local food processing factories and milk plants to utilize the municipal sewer and treatment works in solving their waste disposal problem. The solution has proved interesting, economical and practical. It deserves the attention of numerous small municipalities and local industry faced with the problem of overloaded treatment works and industry's query: "What are we going to do with it"—meaning their waste.

"A Method of Estimating Yields from Underground Sources"—by L. R. McNamee, Cons. Engr., Ann Arbor, Mich., describes a method employed by himself for theoretically estimating the volume of underground water flow and determining well locations most suitable in developing a source of supply and a dependable yield. Confirmation of the correctness of the method is presented in the form of pumping records from wells, located in accord with the theory.

"Practical Electricity in the Plant"—The first of a series of articles by Marsden C. Smith on the A.B.C.'s of electricity, written in simple language for water and sewage works operators, appears in this issue. These articles will continue to run through several issues. Coming from a graduate electrical engineer and water works operator, they should be of value to engineers as well as technically trained operators.

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Delivering Water night and day for 106 years !

Unretouched photograph of a section of 106-year-old cast iron water main still rendering satisfactory service in Philadelphia's distribution system.

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

WATER is free if you go and get it. But if you want it at the turn of a faucet you must pay for the service. Less than the price of a soda for a hundred gallons—a very small cost for an efficient and indispensable public service. One of the reasons why water is cheap is the long life and negligible maintenance cost of cast iron water distribution mains. More than 95% of the pipe which distributes water to the 24 million residents of our 15 largest cities is cast iron pipe.

Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS — RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 83 OCTOBER, 1936 No. 10

Chicago's New Cermak Pumping and Chlorinating Station.

CHICAGO'S NEW CERMAK PUMPING STATION

By LORAN D. GAYTON
City Engineer, Chicago, Ill.

The Author

THE growth of Chicago's water supply system to a capacity where over one billion gallons of water is furnished daily, has required the placing in service, one by one over the past eighty years, of twelve major pumping stations. As the older stations became obsolete and inefficient, rehabilitation and renewals have been a part of the progressive policy which has been adopted to keep all stations modern and efficient.

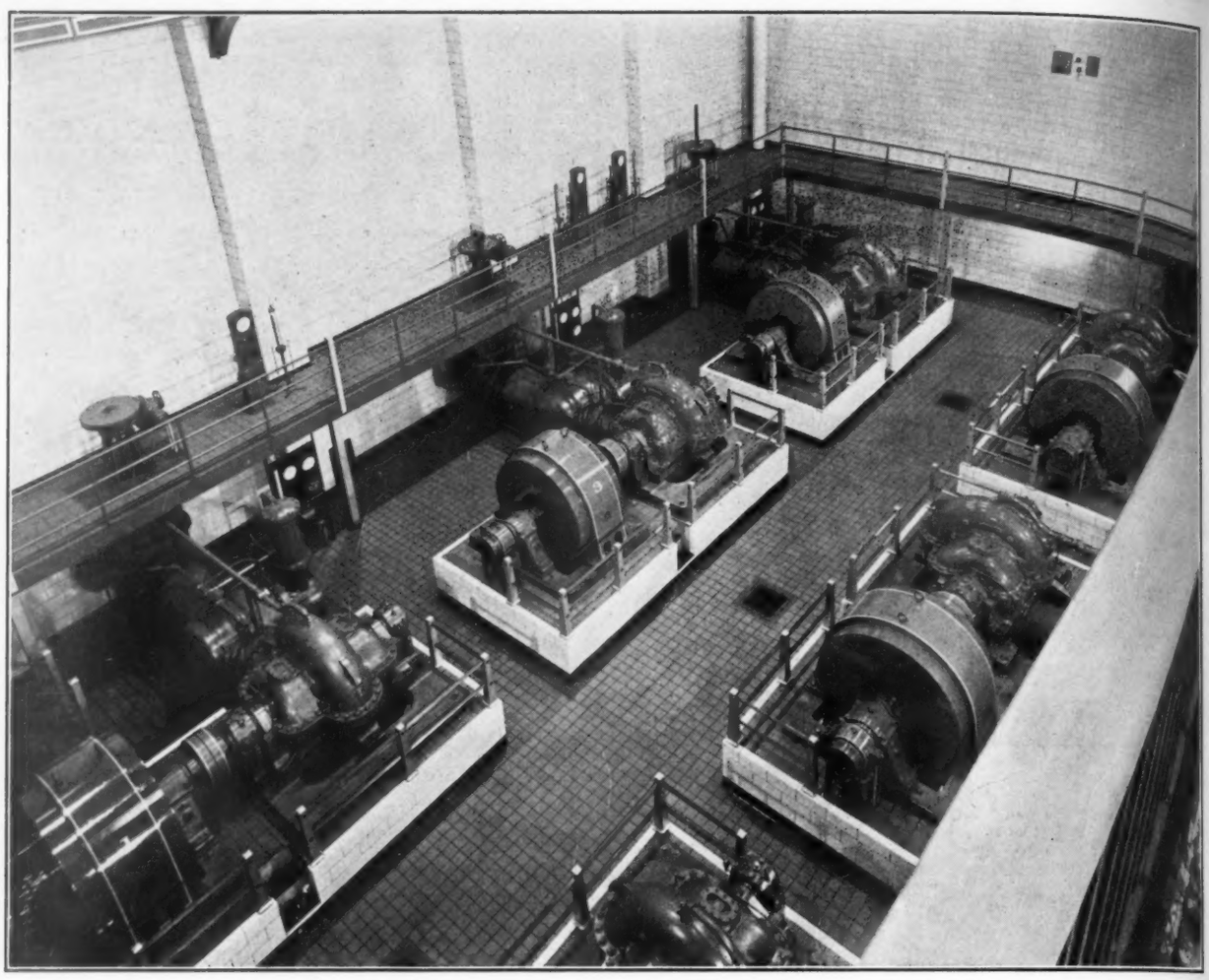
Due to the obsolescence of the equipment installed in the 22nd Street, Harrison Street and 14th Street Pumping Stations of the City of Chicago, the operating cost of these stations was increasing year by year until it was far out of line as compared with Chicago's more modern stations. Also the maintenance costs were rapidly becoming prohibitive. In addition to all this, both Harrison Street and 14th Street stations, although being steam operated stations, had no railroad connection. Thereby, all coal had to be delivered by trucks, thus increasing further the over-all costs. The cost of operating and maintaining three stations of comparatively small capacity is, of course, much greater than would be the cost of one large capacity centrally located plant.

The new Cermak Pumping Station was built to replace these three obsolete and uneconomical pumping stations and has an installed capacity of 300 m.g.d. This new plant is the largest electric motor driven pumping station in Chicago's water supply system and equals in installed capacity the Western Avenue Pumping Station, where steam is used as motive power. The location of the new pumping station is on the piece of property at 735 W. Harrison Street, formerly occupied by the old Harrison Street Pumping Station.

The Cermak Station in Brief

The station structure embraces the over-all area of 62 feet by 192 feet. The exterior design is of Georgian Colonial architecture; the walls are faced with sand mould colonial face brick; the base course consists of rough cut Wisconsin granite and the trim is of Indiana limestone. The skeleton frame work is structural steel and the foundations and retaining walls are of reinforced concrete. The soil at the site is a soft clay and, therefore, for the retaining walls and discharge pipe-vaults a supporting foundation of treated oak piles is used.

In the south half of the building is the pump room, the operating floor of which is 30 ft. 3 in. below the ground line, and the parapet walls are 36 feet above the ground line. The interior walls of the pump room are lined with 8x16 terra cotta blocks and floors are of 6x6 quarry tile.



Pump Room of Cermak Station, Chicago. 300 M.G.D. Capacity—6 Units of 50 M.G.D. Each—Overall Tested. Efficiencies 88.56 to 89.15%. Guaranteed Efficiencies: 50 M.G.D. Pumps, 90%; Motors, 97.9%; Both Being Exceeded in Tests.

The north half of the building has 16 ft. interior height and houses the chlorine rooms, the chief operating engineer's office, the transformer room, chlorine storage room, screen and sluice gate shaft room and the employees' and public toilet rooms.

The switch room located in the sub-basement is lined with terra cotta, the chlorine rooms with glazed brick, and walls and floors of the public corridors are lined with marble.

All window frames and sash and all exterior door frames are constructed from aluminum steel; all doors and interior door frames are made of steel. Obscure wire glass is used in all the exterior windows except on Harrison Street frontage where plate glass is provided.

Water Fire-Curtain

A dry sprinkler system is installed, which will provide fire protection for the entire roof of the station and for all exterior doors and windows. When in operation the entire building will be protected from external fire hazard by a curtain of water.

An overhead 15-ton electric traveling crane is provided which travels full length of the pump-room and is capable of handling the heaviest equipment located in this area.

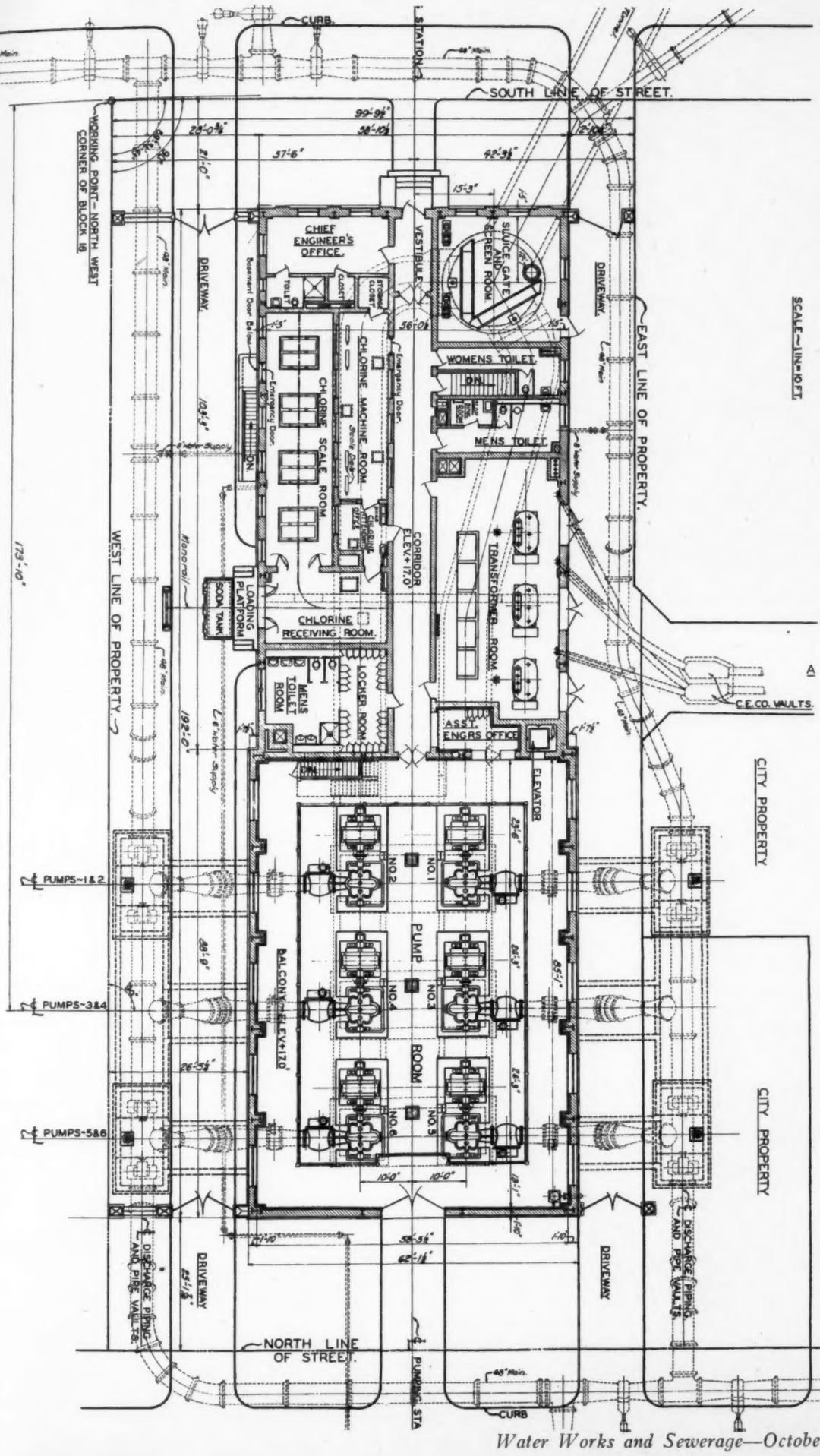
In the screen and gate shaft room, at the northeast corner of the station, there are located the floor stands for hand operation of the 96-inch sluice gates and the electrically operated screen hoists for the 11-ft. 10-in. x 14-ft. 9-in. screens, all serving the 8-foot tunnels below. This room is entirely walled off from the rest of the station; access being by an exterior door on east side, thus protecting the interior of the station from surge in the tunnel by confining it to the screen room alone. An opening in the east wall, 11 square feet in area, has been provided for draining out into the alley any water entering the screen room due to surge.

Pump Efficiency Exceptional

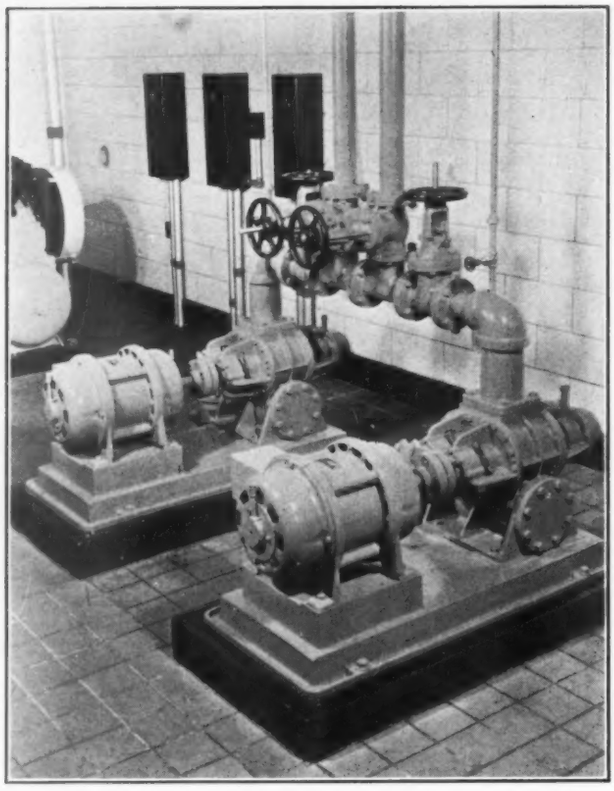
The pumping equipment consists of six electric motor-driven direct connected centrifugal pumps. The pumps, furnished by the Allis-Chalmers Mfg. Co. each has a capacity of 50 M.G.D. against a total head of 136 feet. The motors, furnished by the Westinghouse Mfg. Co., are synchronous and each is rated at 1,500 H.P. 2,300 volts, 3-phase, 60-cycles, and operate at 514 R.P.M. The efficiency of the motors was guaranteed at 97.9 per cent and the efficiency of the pumps at 90 per cent. These are the highest guaranteed efficiencies ever offered on large pumping units for Chicago's water-supply system.

Preliminary acceptance tests on the pumps and motors gave the following results:

Motor efficiency	guaranteed		97.9 per cent
	actual test		97.95 per cent
Pump efficiency	guaranteed		90.0 per cent
	actual tests	No. 4	90.41 per cent
		No. 6	91.02 per cent
Over all efficiencies (wire to water)	No. 4		88.56 per cent
	No. 6		89.15 per cent



Chicago's Cermak Pumping and Chlorinating Station. General Plan at Elevation + 17 ft.



Duplicate Air Compressors Amply Valved for Dependable Service—Cermak Station.

For electric power supply there are three separate feed lines, each coming into the station direct from a generating station. Each line has a capacity to supply the requirements of the entire station. Two of these lines come from the Fisk St. Station of the Commonwealth Edison Co. and one from their Crawford Avenue Station. All lines are located in underground ducts.

There are three main station transformers provided by the Commonwealth Edison Co., of 5,000 K.W. each, any one of which will carry the station load.

The switch gear consists of eight switches, rated at 250,000 K.V.A. and are of metal clad type, encased in steel enclosures, providing absolute protection against danger of injury to the operators.

Deep Pump Pit

The pumping units are located in a pit where the operating floor is 30 ft. 3 in. below the ground line. At elevation—10, the center line of the pumps is 25 feet below the ground line. Two sump pumps of 250 G.P.M. capacity and two of 125 G.P.M. capacity, driven by submerged proof motors, take care of the normal sump capacity.

Special provision is made for pumping out the pump pit should it ever be flooded due to a break in the castings of pumping equipment or any other cause. A stand-by vertical shaft pump of deep-well type, having a capacity of 850 G.P.M. is provided, with its motor located on the visitors' gallery above the ground line, where it can operate under flood conditions. We have, however, minimized the necessity for this equipment by increasing the strength of all pumping equipment such as suction valves, pump casings, discharge valves and piping by 50 to 75 per cent above normal strength required, and have made test conditions correspondingly severe.

Valving Arrangements

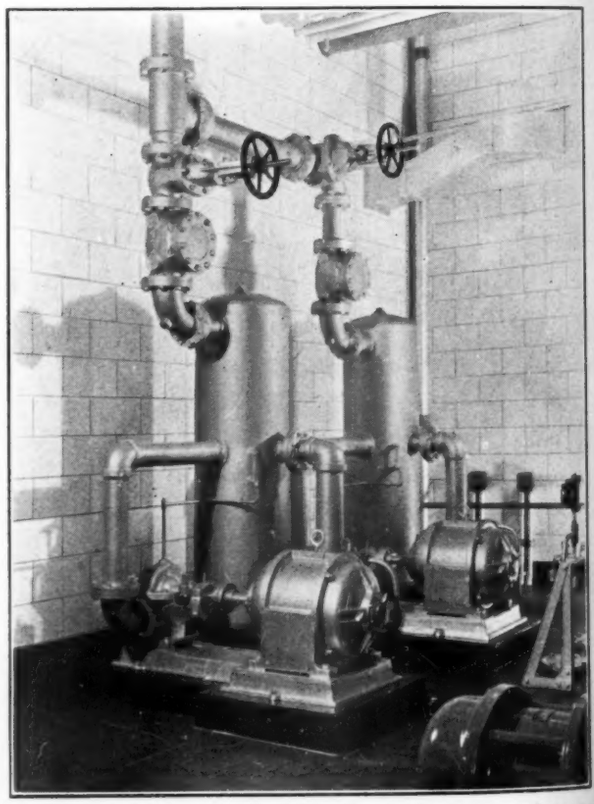
The suction of each pump is provided with a 36-inch hand-operated cone-valve. The water leaving each pump passes first through a 30-inch hydraulically operated automatic cone-check valve, continues on through a 36-inch electrically-operated solid wedge disc type gate valve, thence through the Venturi meter tube to the main headers. The Venturi tube is located in the distribution header vault outside of station walls. This vault is built independent of the main station structure, access being obtained only through a man-hole in the roadway alongside of the station.

In the discharge system there are eight 48-inch and eight 36-inch gate valves which make it possible to send the whole or any part of the pumpage in any one of the four directions in which the distribution piping radiates from the station, thus giving a flexible control of the entire station output. All valves are electric motor operated, solid wedge disc type. Each motor is waterproof and is controlled in a central control room in the station; colored lights on the control panels indicate at a glance the opened or closed position of each valve.

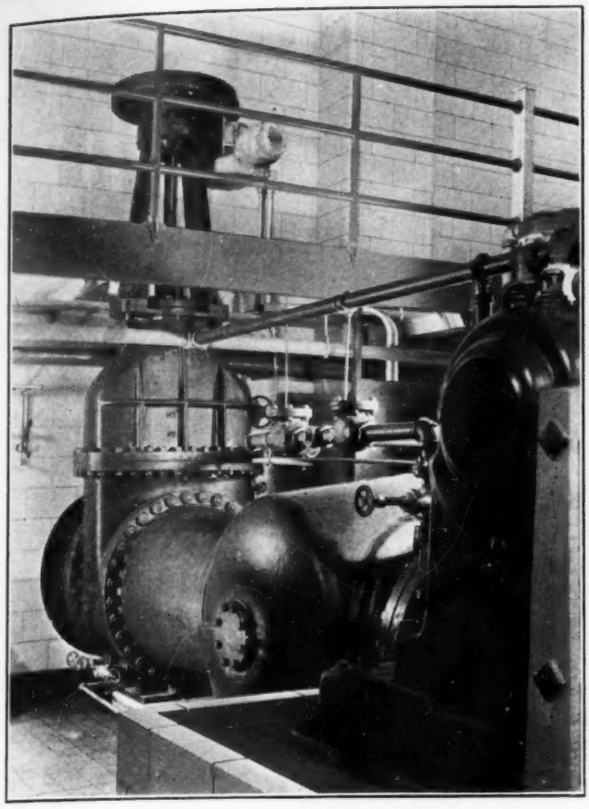
When in operation this station will take the entire capacity of the present seven-foot diameter Blue Island Avenue Tunnel, which receives its water from the Wm. E. Dever Crib and the present seven-foot diameter Polk Street Tunnel which receives its water from the Four-mile Crib.

These tunnels meet in front of the station at a 12-foot diameter shaft from which a 10-foot diameter tunnel leads to the 17-foot diameter screen and gate shaft, located in the northeast corner of the station building. This gate shaft makes it possible to isolate one-half of the entire pumping equipment at any time.

From the screen and gate shaft there branches out two 8-foot diameter manifold tunnels which parallel



Duplicate High Pressure Fire Pumps Arrangement for Providing Sprinkler System and Water Curtain to Protect Station Walls—Cermak Station.



Pumps, 36-in. Automatic Hydraulic Cone-Valve, 36-in. Motor-Operated Gate Arrangement—Cermak Station.

each other under the station. In each there are three vertical 5-foot diameter suction outlets and each outlet connects to a 50 M.G.D. pump.

Chlorinating Facilities*

Chlorination equipment of the latest design is installed with sufficient capacity to protect the water supply of the station under peak load conditions. One-ton chlorine containers are used, making this the first installation for containers of this large size in any of Chicago's pumping stations.

The maximum chlorine capacity required is 3,000 lbs. per day, permitting a dosage of 10 lbs. per million gallons on a pumpage of 300 M.G.D., or 15 lbs. per million gallons on a pumpage of 200 M.G.D.

Four Wallace and Tiernan chlorine machines, each having a capacity of 750 lbs. per day, will take care of this load. The weighing of the chlorine is by means of four Toledo six-ton floor scales with automatic weight recording mechanism. Each scale is capable of holding a maximum of three one-ton containers.

The ton containers are readily handled by a two-ton electric monorail hoist which can travel from delivery truck in the roadway alongside of station to the storage room or scale room, as required.

A substantial ventilating and exhaust system is provided in the chlorine rooms which provides four air changes per hour under normal operating condition, but is capable of providing two air changes per minute under emergency conditions of excessive gas leakage.

*In another issue A. E. Gorman and H. H. Gerstein, of the author's staff, will describe the Cermak Chlorinating Plant and its operation in some detail.—Ed.

Costs

This station, including all necessary tunnels, tunnel connections and distribution system, cost approximately $2,327,000.00. This amount of money was secured by a sale of an equal amount of water certificates to the Reconstruction Finance Corporation in 1932.

Under normal operating conditions this station will supply water to an area of approximately 13 square miles, but due to the flexibility of the discharge system, if it becomes necessary in case of a major fire in the adjacent high value area of the city, this station can throw a tremendous volume of water into that section.

With the New Cermak Station in operation, we shall have six pumping stations steam-operated, and four stations electrically operated, making a total of ten stations on the line. Then, approximately 37 per cent of our capacity will be electrically operated and 63 per cent steam operated.

▼

New Jersey Water Works Meeting

In Which Three Associations Join Forces At Atlantic City

Sponsored by three water works associations established in New Jersey at various times for various purposes, the first joint meeting of these organizations is expected to be a banner N. J. Water Works Meet.

Place—Atlantic City's Hotel Ambassador.

Dates—October 23 and 24 (Friday and Saturday).

Triad—The N. J. Water Works Association, South Jersey Water Superintendents Association, The N. J. Section of A.W.W.A.

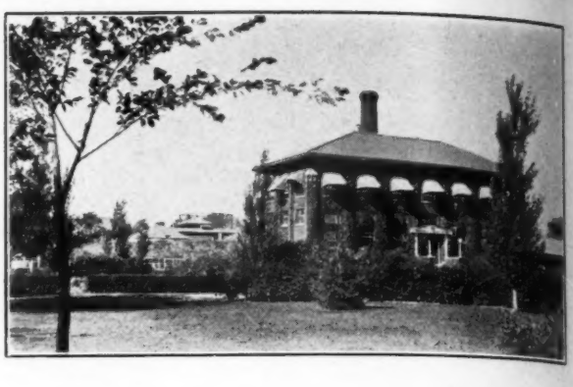
A feature planned is the dinner meeting at 6:30 p. m., October 23, when A.W.W.A.'s President, W. W. Hurlbut, of Los Angeles' Water Dept., will be the principal speaker, followed by J. W. Wyks, Public Service Co. Superintendent, of Trenton, N. J., and Judge H. B. Wells, of Bordentown, N. J., a speaker of force and staunch friend and worker for the water works man in matters pertaining to security of office, betterment of position, public recognition.

A golf tournament has been arranged (Jack Faulkes in charge) for Saturday afternoon.

The technical sessions open at 10:30 a. m., the 23rd. On the well-balanced program the following appear to be the high-lights. (1) Supt. Van Gilder and Eugr. Williams, on Atlantic City's Water Works Improvements. (2) Some Experiences in Well Construction, by Supt. J. A. Carr, of Ridgewood. (3) Water Works Finance and Accounting Practices, by Jack Schwartz, N. J. Utility Commissioner. (4) New Methods and Devices in Water Treatment, Dr. Rudolfs (Rutgers University); Geo. Spalding (Hackensack); Frank Green (Little Falls). (5) Correction and Protection of Distribution Systems, by Hutton (W. & T. Co.). (6) Deisel Engines in Water Works Practice, by Wechter (Worthington), and Engr. Schiverea (Freehold).

The meeting closes at noon Saturday with a big Round Table discussion arranged by Charlie Dore, well known live-wire superintendent of water works and sewage, Collingswood, N. J.

Luncheon; and, then the golfers to golf; the boardwalkers to walk; the shoppers to shop (ladies are especially invited). The registration fee—men, $1.00; ladies, a smile.



Sewage Treatment Works of Springfield, Ill. Digesters and Gas Holders, Left Background

EXPERIENCES WITH GAS ENGINE OPERATION

What Has Been Learned During Three and One-Half Years of Use

By W. B. WALRAVEN*
Springfield, Illinois

There has been a steady and justified growth in the adaptation of gas-engines as power-producing units at American sewage treatment works.

The author of this article was the first engineer in America to make a genuinely successful installation, although others had earlier made installations which were partially successful.

The first published account of the successful and paying installation at the Springfield, Ill., plant was the contribution by Mr. Walraven, which appeared in the May, 1933, issue of WATER WORKS AND SEWERAGE.

We considered it of value to our readers to have this enterprising engineer prepare the present article, in order that others might learn of the continued dependability of gas-engines operating on sludge gas; and, the sustained and proven economic success of Mr. Walraven's pioneering project.—Editor.

THE May, 1933, issue of WATER WORKS AND SEWERAGE contained an article, by the writer, which described the installation of a gas-engine at the sewage treatment works of Springfield, Illinois, and included a summary of tests upon which were based the predicted annual savings.

At the time this was written, the engine had been in service for only two and one-half months, and since the development of power at sewage treatment works in America was in its infancy, I tried to be extremely cautious in my predictions, lest erroneous impressions be created. Fortunately for all of us, the installation has proved more satisfactory than even I had dared to think possible. Every favorable prediction has been surpassed, and each year leaves behind it a better record than that of the preceding one. It will be recalled that the first engine was put into service on January 2, 1933, driving a Connersville air blower, the air required by the aeration tanks having previously been supplied entirely by electric motors. Table No. 1 discloses in a startling manner the continued drop in the amount of power purchased to compress the air.

TABLE NO. 1

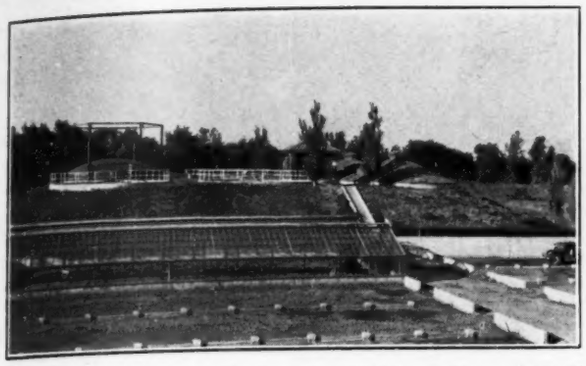
Calendar Year	KWH per month purchased to compress air	Per cent of Aeration Power from gas engines
1932*	104,258	0.00
1933	43,280	52 20
1934	16,328	82.50
1935	11,663	85.20
1936**	1,900	98.00

*Prior to installation of gas engines.
**Based upon first eight months of 1936.

Importance of Engine Selection

There are so many factors involved that, even after forty-four months of continuous operation of the engines, the writer hesitates to make forecasts or to set up figures too definitely, because there is the ever-present danger that they might be accepted blindly as being applicable to conditions other than those pertaining to Springfield, Illinois. However, there can be no question concerning the fact that we have consistently learned how to more effectively get the most out of our gas supply. During the year 1933 we played too safe with our engine, and failed to make it perform to its fullest ability. For this, my only defense is that I was treading uncharted waters and consequently took few chances. Later on when I felt more secure, I permitted the engine to be "opened up," with the result that we now are getting everything out of the installation that anyone might expect. The results for the first eight months of the present year (1936) are undoubtedly "too good" and we have no assurance that such high production will be maintained. However, I now feel justified in believing that the gas available from activated sludge treatment plants can safely be depended upon to furnish more than 85 per cent of the air required, provided the engines are well selected, and placed in direct-connection

*Engineer, Springfield Sanitary District.



Sludge Beds; Digestion Tanks; Gas Holders—Springfield, Ill.

with the blowers. The results also show conclusively that the waste heat from the engines is sufficient to keep the digestion tanks at a temperature of 90 degrees Fahrenheit during zero weather.

The first engine, manufactured by Clark Bros. Company, is four cycle, six cylinder, and is rated at 180 B.H.P. at 514 R.P.M. and 66 lbs. Br.M.E.P. It drives a Connersville blower. The second engine was manufactured by Worthington and is 4 cycle, 3 cylinder, rated at 157 B.H.P. at 350 R.P.M. and 67 lbs. Br.M.E.P. The Worthington engine drives both a Connersville blower and an electric generator. Since the Clark engine is used only to compress air, we can operate it at any desired speed between 300 R.P.M. and 514 R.P.M., but we have to run the Worthington at constant speed for the generation of electricity.

Costs and Savings

The initial installation cost $15,735. Of this, $7,475 represents the cost in place of the engine and heat salvage equipment, and $8,260 the cost of one floating cover, one gas holder, and the heating coils in two digestion tanks. In the Spring of 1935 we installed a second engine and heat exchanger at a cost of $8,075. This brings our present total investment to the sum of $23,810 if we charge the floating cover, gas holder and heating coils against the power development. If we consider, however, that the treatment plant as a whole was benefited by covering and heating the two additional digestion tanks the cost can be taken as $15,550 for the gas engines and appurtenances.

While it would be interesting to know the gross savings, we cannot give truly accurate figures except those predicated upon the assumption that plant conditions have remained the same as those prevailing in the year 1932, the year before the power development was in service. An indication of the trend may be seen by examining Table No. 2:

TABLE NO. 2

Year	Cost of purchased current per month
1932*	$1,110
1933	541
1934	345
1935	313
1936**	211

*Prior to installation of gas engines.
**Based upon first eight months of 1936.

The decrease in total K.W.H. purchased is more marked than the decrease in the bills because with the lower current consumption, the cost per K.W.H. is higher. Thus for the year 1932 the average cost per K.W.H. purchased was $0.0096, while for 1935 it was $0.012. The Worthington engine has been in service for about eighteen months, supplementing the power developed by the Clark engine. Consequently the years 1935 and 1936 include a reduction in electric bills due to development of part of the auxiliary motor and lighting load as well as that due to decreased power purchased for compressing air. We feel safe in predicting that with conditions comparable to those now prevailing, our total electric bills will average less than $260 per month, which, deducted from the 1932 figure of $1,110, indicates a decrease of $850 per month, or $10,200 per annum attributable to the engines.

Maintenance and Operation

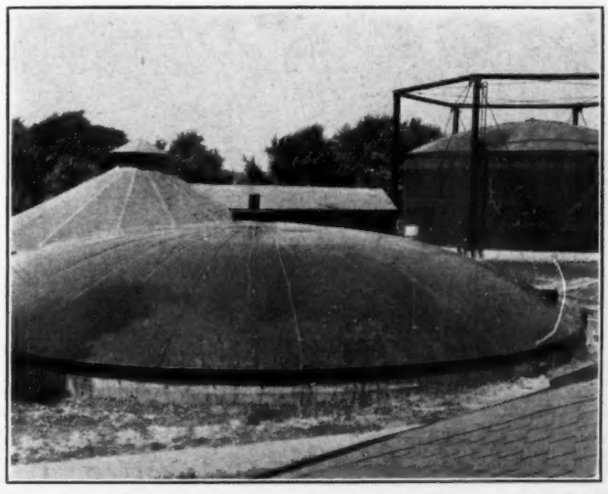
Against the gross savings must be set charges for interest, repairs, and maintenance. Some of these factors are readily determined, while others are still speculative. According to our records, the charges against the installation of the two engines, floating cover, storage holder, heat salvage equipment, and appurtenances have been as given below:

TABLE NO. 3
ANNUAL CHARGES

Interest	$23,810	@ 0.045	$1,071
Lubricating Oil	660 gal.	@ $0.36	238
Labor of maintenance	54 man days	@ $4.00	216
	18 man days	@ $8.00	144
Materials for maintenance			111
		TOTAL	$1,780

The gross savings were previously calculated at $10,200. Consequently the net savings are $8,420 per annum, thus indicating that the installation should completely pay for itself, including interest, every 2.8 years. It may be seen that the savings are considerably more than enough to pay for a new engine each year. If our purchased power rate were higher, the annual savings would of course be greater, but we feel satisfied to have done as well as we have.

For different situations, other figures would have to be used in computing charges. As a practical matter our "labor of maintenance" has cost the Sanitary District nothing, because the same men would have been employed if no gas engines were installed. In plants where the normal operating personnel is already taxed to capacity, the labor of maintenance might possibly

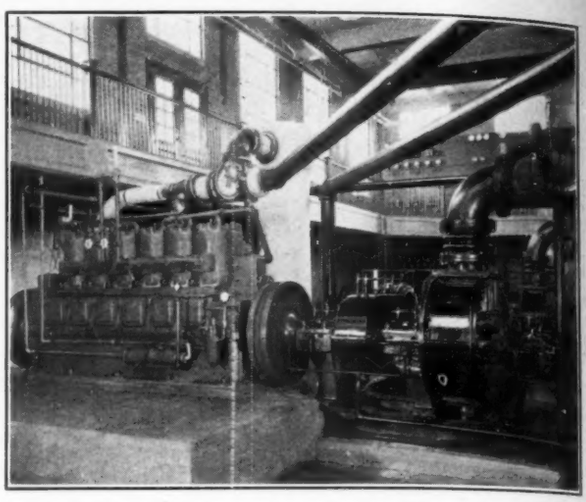


Three Types of Gas Collectors at Springfield. Gas Holder; Fixed Steel Cover (Foreground); An Early Model Floating Cover Under Wooden Roof

require the addition of a man to the payroll. However, a good gas engine should run with a very minimum of daily attendance, and we find that our labor charges come largely at the times when the valves and the piston rings require attention. In general we try to grind the valves three to four times a year, and pull the pistons perhaps twice in three years.

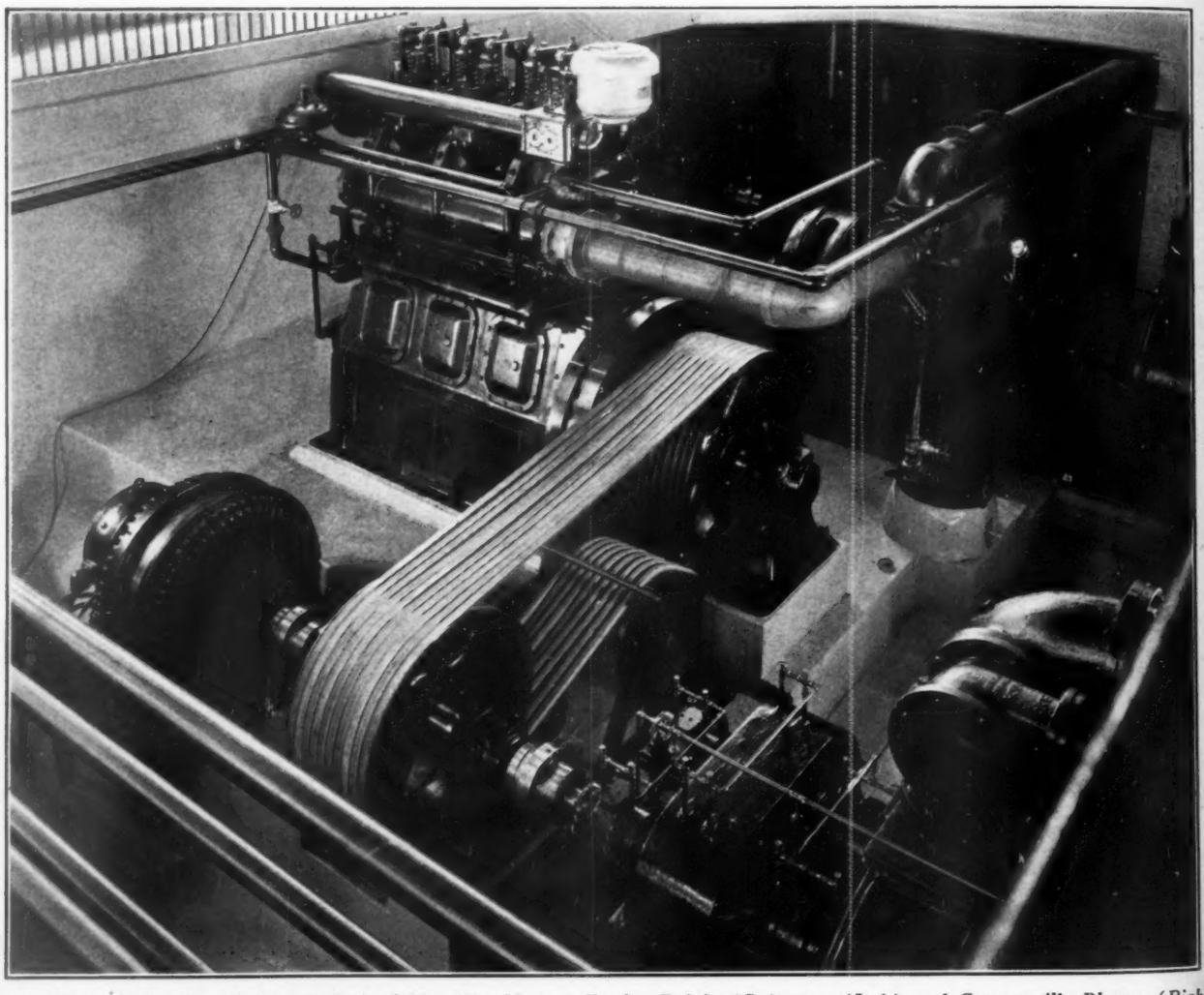
To date the engines show no signs of depreciation, performing as well or better than when installed. We naturally expect to pay more for future maintenance, but have every right to believe that the effective service life of the engines will reach twenty years, barring serious accidents. However, they have long since paid for themselves and every hour they run represents additional net savings to their credit.

In my initial article (May, 1933, issue of WATER WORKS AND SEWERAGE) I estimated that a gallon of lubricating oil might serve for 3,000 brake horse power hours of work. Experience has proved that I was too optimistic, actual data showing that a figure of 2,000 is more nearly correct. Whether we use oil for too short or too long a period of time is a question, but it appears better to be liberal with lubricants rather than run the risk of damaging the engines. In the initial article I also predicted that we might compress air with gas power during 90 per cent of the time and run the engine at average speed of 307 R.P.M. Our performance for the past three years has greatly exceeded my estimate. During several periods, the gas engines were



Springfield's First Gas Engine: Clark Engine Driving Roots–Connersville Blower

operating constantly for four months without a shutdown. As a matter of fact, at the time of writing, we had not used the electric blower a single minute in the preceding five months. This is too long to run the engines without attention, but not having complete gas stand-by service, we are reluctant to stop them for repairs as long as the gas supply is plentiful. This, however, may be a "penny-wise" policy.



Second Gas Engine Installation at Springfield: Worthington Engine Driving Generator (Left) and Connersville Blower (Right)

Engine Performance

The 1933 test data indicated engine performance of around 22 per cent brake efficiency. By changing cylinder heads, time of fire, and gas-air ratio, we succeeded in raising the efficiency to as high as 25 per cent, when the engines were well loaded and when they were in tune. A complete series of tests verified the well-known fact that gas engine efficiencies drop rapidly when the B.M.E.P. falls much below 50 pounds. Consequently with any new installation it is well to study the load characteristics in advance and strive to keep the engine loaded between 50 and 70 pounds. With constant displacement air blowers and with some pumping set-ups, this is easily accomplished, whereas, with an electric generation installation it is generally more difficult.

We readily recognize the fact that whatever degree of success we may have had is attributable largely to a fortuitous combination of circumstances, a well balanced plant, adequate control, and a board of trustees willing that we of the technical staff carry on useful experimentation. Too often this feature of plant operation is not given the importance it deserves, but having the whole-hearted cooperation of our board, we were permitted to try new things which fortunately proved their worth.

Growth Since 1933

Having paced the field in America, the Springfield, Illinois, installation has now dropped back to fourth place so far as concerns size of gas engines at sewage treatment plants. Three units of 300 H.P. each are under installation at N. Y. City's Coney Island plant. At Peoria, Illinois, engines totalling 835 H.P. are now in service, and Topeka, Kansas, will soon operate 600 H.P. Next below Springfield with 337, comes Durham, N. C., and Cedar Rapids, Iowa, with a 300 H.P. each. Los Angeles County has 200 H.P. and will shortly have 400 H.P. Many other units ranging from 150 down to 15 H.P. are also running, apparently successfully, and demonstrating the economic practicability of gas-power development.

We at Springfield are pleased to have been able to participate in a widespread interchange of knowledge. We acknowledge our indebtedness to the almost forgotten plant in New South Wales, Australia, where some thirty years ago an enterprising engineer experimented with a small engine operating on septic tank gas. Similar experiments in Bombay and Singapore, while not entirely successful, were, in 1923, brought to a satisfactory conclusion by Whitehead at Birmingham, England. From Mr. Whitehead, I received sufficient information to enable me to proceed.

To complete the truly international exchange, Engineer H. J. N. Hodgson, from Adelaide, South Australia, visited the Springfield plant a short while ago in order to study our installation. So back to the land of its birth goes the idea of converting digestion tank gas into power.

S. E. Kappe Joins Chicago Pump

Sam E. Kappe, former Assistant Engineer of the Pennsylvania Department of Health, has recently accepted a position with Chicago Pump Company.

A graduate of Penna. State College, Mr. Kappe for several years was located in the Philadelphia District office of the Penna. Department of Health, under Harry W. Freeburn, Distr. Engr. More recently he has served as Engineer in Chage of the pollution studies of the Delaware River, conducted by the U. S. Engineer's Office. Mr. Kappe brigs to Chicago Pump Company the points of view of the public health engineer and the operator.

The company plans to establish an Eastern office in Philadelphia from which Mr. Kappe will operate as Engineer in Charge of the Eastern District. For the present, however, he advises that he is spending some time in the factory at Chicago (2336 Wolfram St.) in order to thoroughly familiarize himself with "Chicago" equipment which he is to handle.

Virginia Planning Another Exceptional Meeting

At Charlottesville, Va., the home of Jefferson, "Jeffersonian Democrats" and Virginia's far-famed University, will be held the Annual Meeting of the Virginia Section of A.W.W.A. and Virginia Sewage Works Association. Headquarters: Hotel Monticello. Dates: October 29 and 30.

Again this year; exhibits have been arranged for (without charge to manufacturers exhibiting—direct or otherwise) principally because officials of the Section realize the educational value as much as the advertising value of exhibits of equipment and materials.

Last year, at Roanoke, Va., the Virginia Section held an exceptional meeting. Was acclaimed by A.W.W.A.'s President, Frank Barbour, other officials and manufacturers, as the finest thing of its kind ever staged by a Section of A.W.W.A. In these pages it was recorded as Virginia's "Little Convention" and so ranked, in attendance, quality of technical program, entertainment, exhibits and dignity. So impressed was President Barbour that the Past President plans to attend the Charlottesville meeting as "Frank Barbour of Boston" and President W. W. Hurlbut will come from Los Angeles to do honor to Virginia's up and coming (up and *going* is better) Section of which S. L. Williamson, City Engineer of Charlottesville is Chairman (also in charge of arrangements). E. F. (Gene) Duggar is National Board Director; Marsden Smith is general "wheelhorse" and in charge of the Technical Program.

To beat Doc. Taylor's (1935 Chairman) Roanoke meeting, the boys have got to go some. But, "you-all" know those Virginians go places when they are "a-mind-to." So, plan to go to Charlottesville if you would know Virginia ham, fried chicken, batter-bread. And, Oh, yes, "cawn-likka" too, if you like it.

(Regret that the completed program is not available at this writing.—Ed.)

Apologies Are in Order

We express regrets to Mr. A. L. Meisel, City Manager of Williamsburg, Va., that the picture accompanying his article in our September issue (page 352) would hardly be recognized by his wife as that of her husband. To Dr. H. O. Halvorson, our apologies for mis-labelling. Unaccountably, Dr. Halvorson's picture appeared twice: Once with his article on page 307; again on page 352 in Mr. Meisel's position. Above is Mr. Meisel's picture and we hope he will recognize himself this time.

A. L. Meisel

NEW ENGLAND WATER WORKS ASSOCIATION HOLDS 55TH ANNUAL CONVENTION

"HAPPY Days Are Here Again!" was the keynote of the 55th Annual Convention of the New England Water Works Association—held at Hotel Pennsylvania in New York City, September 22-25 inclusive. Upholding predictions, the official registration of 719 was a bellringer; and the 58 manufacturer's exhibits constituted a record in number and note-worthiness.

Highlights

Highlights of the technical program were the following:

The paper on "British Water Works Practices" presented by an honored guest, Harold J. F. Gourley, Past President of the Institution of Water Engineers and a partner in the well known London firm of consultants, Binnie, Deacon and Gourley; a symposium on the floods of 1936 in Northeastern United States, participated in by four leading State Sanitary Engineers, U. S. Weather Bureau engineers and chief engineers and managers of water works; a report on "The Katadyn (Silver) Process of Water Purification" from New York City's Department of Water Supply, setting forth findings and conclusions growing out of tests of the process; the paper by W. W. Moorehouse, Sup't of Water at Dayton, Ohio, which dealt with the interesting development of Dayton's Ground Water Supply; the paper by John R. Baylis of Chicago, on methods of "Improving the Operation of Rapid Sand Filters"; the Round Table Topic, "Determining the Proper Size of Mains and Services," led by E. T. Killam; and, another, under caption "Meter-Masters, the G-Men of the Water Works," which revealed interesting and profitable experiences of prominent superintendents and engineers with the portable recording "Meter-Master"; the reports of the Secretary, Treasurer, Finance Committee—and the President's address—all showing the business-like administration which the association has enjoyed during the past year.

What a Succession

Roger W. Esty, Retiring President; Harry U. Fuller, Incoming President. The Only Thing in New York "Bigger" than the Pair Was the Empire State Building, Which Shows Dimly Between Them

Elwood L. Bean, Providence, R. I. To Him the Dexter Brackett Medal Award

H. J. F. Gourley, Cons. Engr., London, England. From the British Institute of Water Engrs. He Came As An Exchange Speaker

Certainly amongst the "highlights" should be mentioned that ludicrous presentation "Free Water—or, God's Gift," which might also be captioned "The Lament of a Water Works Superintendent," as told by Sup't J. McClure Wardle of Hudson, N. Y., who distributes much water, collects for little.

Honors and Awards

The single Honorary Membership awarded this year was bestowed upon Thaddeus Merriman, who since his resignation as Chief Engineer of the New York Board of Water Supply in 1933 has been engaged in consulting practice. In presenting the membership to the absentee, called to California on the Southern California Metropolitan Water Supply Project, Frank E. Windsor (Hon. Member) cited the many outstanding works of the recipient, dating from his early work on America's first engineer designed rapid filter plant at Little Falls through his services with the New York Board of Water Supply. Mr. Merriman is Editor in Chief of Merriman's Handbook for Civil Engineers and received the honorary Doctor of Engineering degree from his *alma-mater*, Lehigh University.

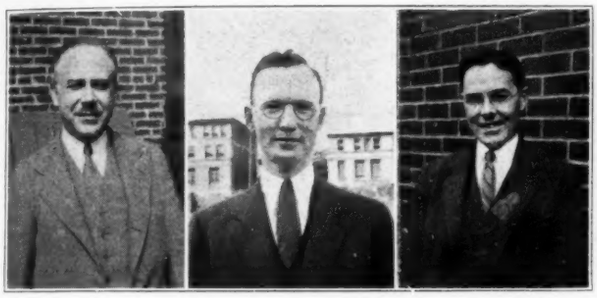
The Dexter Brackett Medal was awarded Elwood L. Bean, Chemist, Providence (R. I.) Water Department, for his technical prowess and his paper, "Providence Water Treatment." In the presentation, Karl R. Kennison, Chairman of the Award Committee, complimented the medalist on his ingenuity and resourcefulness in varying the treatment at Providence, to meet changing conditions in the removal of manganese and color and in control of corrosion. Mr. Bean, a graduate of Brown University, has for the past 10 years been responsible for water purification at Providence.

The President's Address

In his address at the close of the Convention, President Roger W. Esty took occasion to emphasize the financial support given the Association by the Water Works Manufacturers Association, more especially those members who also supported the Journal by

advertising therein. He requested members to make especial effort to acknowledge as much by patronizing advertising members of the Manufacturers Association. As to membership growth, he paid tribute to Harold Brigham's work as Chairman of the Membership Committee and offered the slogan "Every member, one new member." Tribute also to E. Sherman Chase for his work as chairman of the program committee; to E. T. Killam for the outstanding published report of his committee on Pipe Line Friction Coefficients the value of which to the water works industry had hardly been realized (Reprints of this report are available at the Secretary's office.—Ed.); to the State Department of Health engineers for their fine work in aiding water works operators during the disastrous floods last Spring.

Mr. Esty dwelt with feeling on the matter of social security and old age security of water works managers and operators, and the utility aspect of water supply, as against the political. He referred to the recent law passed in Massachusetts (Chapter 463 Genl. Laws 1936) which establishes a definite pension plan for municipal employees in cities of 10,000 and more population. Concerning neighbor help in disasters such as conflagration and the 1936 floods, Mr. Esty suggested that it would be well for neighbor communities



Brass Hats in N.E.W.W.A.

Gordon M. Fair, Editor, Cambridge, Mass.; Wm. B. Duffy, Chairman of Finance, Andover, Mass.; Warren J. Scott, No. 1 Vice-Pres., Hartford, Conn.

to consider a permanent link between their water systems, in the nature of a connecting main, which might be used in either direction as the case demanded. In closing he thanked all who had given their energy and time to help him in his pleasant duties as President, and to his successor, Harry U. Fuller, he could only wish the same cooperation. Later in the meeting the retiring president was presented with a splendid movie camera as a token of appreciation by his friends for the happy administration and the fruitful one he had given the association.

(Secretary Gifford, in making the presentation, said that in his experience during 14 years as Secretary, no president had put in so much time and effort as had Roger Esty. Never had there been a more business-like administration or a happier one.—Ed.)

Business Meeting

From the reports of Frank Gifford (Secretary) and Leland Carlton (Treasurer), members of N.E.W.W.A. learned that the Association still has a membership of 760 after a "house-cleaning" administration in which 39 members, carried through the depression, had been dropped because of failure to make any payments, whatever, on back dues. Only 31 new members had been added within the year but a number of applications had come in during the convention. The gross receipts had been $11,439.60, of which $3,054 repre-

Lloyd Nelson, Sec'y, Cen. States Sect., A. W. W. A., U. S. Pipe's No. 1 Magician; Put on a Clever Act

"Captain Ned" Herbert, No. 1 Golfer; Came Up from Norfolk, Va., to Show the Yankees How

sented receipts for advertisements in the Journal, $5,400 as dues and subscriptions and $463 as investment income. Uncollected bills for dues and advertising amounted to roughly $500. With investments amounting to $16,317 the total assets of the Association were $17,782. The cost of operating the Headquarters Offices had been $4,463, inclusive of the secretary's salary of $400. Total expenditures by the Association had been $11,611.

The report of the Editor, Gordon M. Fair, revealed that the production of the N.E.W.W.A. Journal during the year, including the editor's salary of $500, had cost $5,880. After deducting income from advertising and reprint sales there was left a net per member cost of $1.97, supplied from dues.

The report of the Finance and Budget Committee presented by W. B. Duffy (Chairman) calls for a total budget of $11,000 for the ensuing year—entailing minor readjustments in allocation of funds and resulting in a more nearly self-supporting Journal, without reduction of size or quality.

New Officers

The following officers were announced for the ensuing year: President, Harry U. Fuller, Ch. Engr., Water District, Portland, Me. Vice-Pres., Warren J. Scott, Ch. Engr., State Dept. Health, Hartford, Conn. Vice-Pres., Geo. A. Sampson, Cons. Engr., Weston & Sampson, Boston, Mass. Secretary, Frank W. Gifford,* Water Works Consultant, Dedham, Mass. Treasurer, Leland G. Carlton,* Registrar of Water, Springfeld, Mass. Editor, Gordon M. Fair,* Harvard University, Cambridge, Mass. Directors, Percy A. Shaw,* H. K. Barrows,* Francis H. Kingsbury.**

*Already serving. **Appointed 1936.

Geo. A. Sampson, Cons. Engr., Boston, Mass. New Vice-President

E. Sherman Chase, Cons. Engr., Boston, Mass., Chairman of Program Committee

Malcolm Pirnie, Cons. Engr., New York City

W. C. Hawley, Ch. Engr., Penna. Water Co.

Entertainment

On the opening day of the convention an inspection of the majestic liner, the Queen Mary was arranged; on Wednesday afternoon an interesting boat trip skirting Manhattan Island; on Thursday the golf tournament at Tamarack Country Club in North Greenwich, Conn., where the ladies also were taken for luncheon and afternoon bridge. In addition, the Ladies Entertainment under the able Chairmanship of Mrs. Wm. W. Brush, offered a fashion show, a tour of Radio City and broadcasting studios, a look behind the scenes in New York's large department stores, and a sightseeing trip.

The customary reception and dance was held on the opening evening. On Wednesday evening the Annual Smoker was held, with Bill Orchard as Chairman of the Committee on Entertainment and Master of Ceremonies, repeating as producer and director of another highly successful show composed of talent drawn from the water works field. Noteworthy was the sleight-of-hand work by Lloyd Nelson, the acting of "Big Chief" Alan Johnstone, the vocal selections by Clinton Inglee, Jack Butler, Jo. Wafer, Miss Anna Reichl; the comedy singing of George Haggeter and the ensemble work of the entire cast on compositions and parodies written by Bill Orchard himself. Repeated encores bespoke the quality of the work by Orchard's N.E.W.W.A. "Puritans," and another successful evening by "home-talent" entertainment for which the versatile producer has become famous. Back-stage was Charlie Eastwood—Bill's right-hand man and stage director. To him, a hand also.

On Thursday a brilliant Annual Dinner-Dance was held on the Pennsylvania Roof where, by popular demand, some of the Smoker selections were repeated by the "Puritans" during the intermission.

Golf Winners

From the Norfolk, Va., Water Department came "Cap." Ned. Herbert to take the "Yankees" for a ride and, with it, the top prize for low-gross score (94) by an active member.

Other top players were:

Low net, H. W. Clark, Supt. Water Works, Avon, N. Y. (He shot a 99.)

Second low gross, L. V. Carpenter, N. Y. Univ., N. Y. City.

Second low net, Jas. C. Harding, Cons. Engr., Mt. Kisco, N. Y. (He shot a 107.)

Associate members:

Low gross, W. J. Lynch, Pittsburgh Equitable Meter Co. (He shot an 84.) Karl M. Mann, Water Works Engineering. (Also an 84.)

Low net, J. A. McBride, National Meter Co. (He shot an 86.) C. R. Ford, Pittsburgh-Des Moines Steel Co. (Also an 86.)

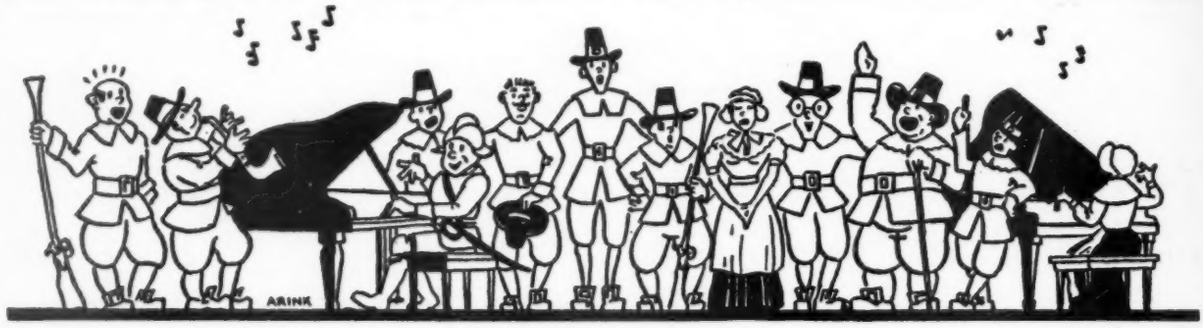
Second low net, R. W. Haywood, Ind. Chemical Sales Co. (He shot 109.)

Technical Sessions

(President Roger W. Esty, Presiding)

A feature on the program was the paper by Harold J. F. Gourley, Past-President of The Institution of Water Engineers and member of the well known engineering firm, Binnie, Deacon and Gourley, of London. The subject of Mr. Gourley's paper, to which this brief digest can not do justice, and a crowded program proved an injustice, was "Some Recent Developments in British Water Works Practices."

The speaker, introduced by E. Sherman Chase, chairman of the Program Committee and Past-President of the Association, was presented as an exchange-speaker representing The Institution of Water En-



Bill Orchard's Puritans

At the Pianos, "Bill" and "Mauna Lowe"—Petite Better Half of Saxophonist, Ruddy Lowe; Fattest, Joe Wafer; Thinnest, Jack Butler; Funniest, Geo. Haggeter; Handsomest, Ed. Reilly; Best Actor, Al Johnstone; Most Professional, Ed Orchard; Best Voice, Clint Inglee; Most Charming, Anna Reichl

"Big Shot" Manufacturers

Rollo K. Blanchard, V.-P., Neptune Meter Co., Director (N. Y. Section), A. W. W. A.; D. Birney Stokes, V.-P., U. S. Cast Iron Pipe Co.; Col. W. F. Rockwell, Pres., Pittsburgh Meter Co.

Thos. F. Wolfe, Research Engr., C. I. Pipe Research Assn.

J. Rossiter Scott, Cons. Engr., S. R. Dresser Mfg. Co.

gineers. The charm of the speaker, his sense of humor, and the breadth of topic, justified a full half-day session for adequate presentation and discussion. Interesting terminology used by the Britisher included "undertakers," when referring to those who undertake the development of water supply—especially those who undertake to produce a well supply. For second-feet or cubic-feet per second the term "Q, Secs" was used. A chuckle came on the heels of his surmise that "the British must be becoming cleaner, because they seemingly need less water per head than do Americans."

Concerning governmental regulations pertaining to British underground water takings, Mr. Gourley stated that private owners in England were not restricted in respect to location, depth, draught, nor could they be held for damage to neighboring wells. A municipality on the other hand was required to obtain approval of its well project from Parliament and subsequent damage to privately-owned wells had to be repaired. The permissible radius of municipal wells to private wells varied with the formation—2 miles in sandstone and 1 mile in the chalk. He reported that a Joint Committee had been set up to bring equality and standardization into the field of ground water supply. Progress had been slow because of the British fondness for precedent in all matters.

As to stream-flows and probable revisions in the setting of compensation-water, Mr. Gourley said that studies were under way on small and large streams. The basis accepted during the past 100 years for determining safe water-shed yields and storage and compensation water to down-stream owners seemed subject to overthrow. Because most dam failures had been traced to deficiencies in spillway capacities the committee proposes a capacity double that required for a normal maximum flood; and, that impounding works be government inspected at least every 10 years and that wave-walls be required to protect erosion of all earth fill. The committee had concluded that a reservoir covering 5 per cent of a catchment area and allowing a 2-ft. head over spillway could be counted upon to reduce flood intensities by 30 per cent; with 10 per cent shed area, by 40 per cent.

Mr. Gourley in discussing progress in dam and spillway design set forth (illustrated) some of the developments based upon experimental work by his own firm at Hong Kong, China, proving the value and economy of circular trumpet-mouth (in America, "Morning-Glory") reservoir outlets connecting into tunnels. The expensive radial piers on the trumpet lip, to check vortex action and air sucking, had been supplanted by a more effective hanging-wall (pictured) across the center and extending well into the trumpet month. He then told of some studies of dam construction leading to economical buttress construction with but 300 pounds of cement per cu. yard, faced with water tight slabs employing a 600-lb. cement mix. Laid up in panels on the buttresses, these slabs were backed with a bitumen sheeting. Backing the buttress-faced concrete core was the rock fill. He then described the unique Silent Valley Dam, with multiple arched hollow core in glacial drift, constructed with cast-iron arched forms.

Malcolm Pirnie, prominent New York Consulting Engineer, in a prepared discussion, recounted recent studies of ground water behavior in Florida to determine intake, flow and discharge. There was a marked similarity between the findings in Florida and England. Observed fluctuations in ground storage had been marked; during the 6 dryest months only 15 per cent of the rainfall had percolated as against 46.5 per cent during the 6 wettest months. He discussed the relationship between intensity incidence of rain fall and effective percolation. Apparently 0.6 inches of rain had to fall before there was any effect on ground water storage and only 25 per cent of the rains were more than sufficient to saturate the upper 3 inches of soil.

Karl R. Kenniston, Assistant Chief Engr., Metropolitan Water District, Boston, Mass., briefly described the Boston system, supplying 20 cities and towns within a 10-mile radius of Boston with water brought in within a 70-mile radius. He compared some of the features of greatest similarity between Mr. Gourley's Silent Valley and Boston's Quabbin dam.

Due to the over-running of schedule prepared discussions by Caleb M. Saville, Chief Engr., Hartford, Conn., Water Commission and Robert E. Horton, Cons. Hydraulic Engr., were not read. In closing the discussion, Mr. Gourley remarked that there was also in England a lag from March to September in observed effects of Winter percolation on ground water levels. There, 2 inches of rain was required in Winter and 4 to 5 in Summer before effects could be detected on the ground water table. Concerning stream control, topography vs. politics entered the picture. Fortunately for England the former ruled in their legal, economic *and political* procedures. Criticized for omitting cost figures from his paper, Mr. Gourley replied that with so many variables to consider in dam construction he always hesitated to quote or compare costs—even in England. For handling large volumes in dewatering operations the Aquatone Pump, consisting of a long tube through which ran a chain lift (40 to 50 feet), and as inefficient as apparent, proved nevertheless an economical practical device for the purpose.

At the close the speaker was given a rising vote of appreciation and thanks for his excellent presentation.

J. M. Wardle, Supt., Hudson, N. Y. "Free Water; God's Gift" Is His Dilemma

Don. Calderwood, Asst. Mgr., Nashua, N. Y. Bends Cement Lined Service Pipe; Avoids Goose-Necks

E. T. Killam, Cons. Engr. (Alex. Potter, Engrs., N. Y. C.). Praised by All for His Report on Pipe Line Friction Coefficients

E. A. Sigworth, Sales Engr. (Ind. Chem. Sales Co., N. Y. C.). A Little Activated Carbon Sprinkled on a Reservoir Will "De-Activate" Bathers

Superintendents' Session

"The Advisability of Water Departments Regulating Water Piping and Fixtures Within Buildings" was the subject of a Committee report presented by Stephen A. Taylor as Chairman. The report pointed out the importance to the water utility of such matters as proper size and materials used as service piping, if there was to be assured satisfactory water quality and adequate pressure at the consumer's tap; the dangers of cross connections and sanitary fixtures, which allow possible back-syphonage into the water system; the proper and safe installation of hot water boilers; the proper grounding of electrical services on water pipes to protect water works operators, meters and services. The committee, cognizant of the success with which the New Bedford, Mass., Water Department had set up regulations and enforced them (for these see WATER WORKS AND SEWERAGE for March, 1936, p. 78), felt that each municipality must determine the proper agency most suitable to handle and enforce such regulations; requested an open discussion of the matter. Mr. Taylor explained that the regulations had been put into effect at New Bedford to protect owners against being sold inferior piping, and to minimize unjust complaints against the water utility due to corroded or undersized piping; and, also, the hazards of syphonage and dangers from boiler explosion or collapse.

In the discussion and questioning following, it was pointed out that a master-plumber had been placed in charge of the New Bedford program under the superintendent of water. One superintendent, Percy A. Shaw of Manchester, N. H., suggested that in any event the water works superintendent should be a member on the board that regulates plumbing practices in his community. It was pointed out by Mr. Cox, of Albany, that there was a lack of agreement between manufacturers as to what constituted safe sanitary fixtures; model codes such as that published by the Wisconsin Department of Health, served as a guide, mainly, and that it would be essential to educate plumbers, along with the manufacturers, through Master Plumbers Associations. One commissioner, Mr. McLean of Holyoke, Mass., voiced the opinion that the water utility would be presumptuous in going on private property for the purpose of dictating to the water taker. Another—David A. Hefferman of Milton, Mass.—showed where, to the contrary, he had saved the owner money by so doing. Having to curtail discussion, it was decided to present the report for further discussion at one of the monthly Winter meetings of the Association in Boston.

"The Use of Couplings," by ROSSITER S. SCOTT, Consulting Engineer, S. R. Dresser Mfg. Company, Bradford, Pa.

With a liberal use of lantern slides, Mr. Scott presented a lucid description of Dresser Couplings for water, gas, air and in sewage-works piping, and their adaptation in a multiplicity of usages on steel pipes from ⅜-inch to 96-inch diameters and cast-iron from 2-inch to 72-inch. Mr. Scott's statement was, to this writer, the most vivid and condensed non-commercialized description of the Dresser Coupling that has yet been presented. Especially interesting was the simplicity, rapidity and economy of the installation, the security of the completed joint even under severe movements of the pipe longitudinally or laterally, and its adaptability under a variety of circumstances, and, also, its emergency use value. One use hitherto not stressed was its value in connecting pumps to suction and discharge lines to preclude strain and to cushion vibration. Pictures were shown of typical installations in several important cities for various purposes, including the recent PWA-WPA Birmingham Industrial Water Supply Project as a record making installation on which Dresser couplings had been used throughout.

The President, Roger W. Esty, in testifying to their value, related some of his experiences at Danvers, Mass., with Dresser couplings where ½ to 20-in. sizes had been used. He stressed their adaptability in making repairs in wet trenches, their value in main repair work, especially during freezing weather, and in service pipe replacement. Notwithstanding the roughness of the corroded outside of service pipes these couplings had made tight joints when connecting a new section into an old service line.

"Activated Carbon—The Water Purifier," By E. A. SIGWORTH, Industrial Chemical Sales Company, New York City.

Mr. Sigworth described activated carbon as the material of a million tiny sponges, which soak up impurities from the water in which suspended. He reviewed the history of the material as a water purifier and taste and odor remover and the phenomenal growth in usage of carbon in the powdered form since first demonstrated by Spalding of the Hackensack Water Company. In making a survey of methods of application it had been shown that the preferred point of application was to the incoming water, just prior to, along with, or immediately after the coagulant application. In cases of severe taste conditions a secondary dosage was applied onto the filters or to the filter influent. As to rates, the average application seemed to be 16 lbs. per million gallons at a cost of $1.00 per m.g., but varied up and down with

H. L. Field, Supt.-Engr., Greenfield, Mass. Built a Filter Plant with Relief Money: Has Paid

Guy W. Classon, Supt.-Registrar, Leominster, Mass. Also Built a Filter Plant as a Relief Project

Masters of the Meter Master

*Percy A. Shaw, Supt., Manchester, N. H.; H. W. Griswold, Deputy Chief Engr., Hartford, Conn.; *John H. Read, Asst. Supt., Manchester, N. H.*

local conditions and changes in water quality. Many plants applied some carbon to the incoming water continuously, feeling that there was justification and economy in so doing to check sludge putrefaction and maintain "sweet" filters. Some were of the opinion that the carbon did more dollar-for-dollar than did aeration, which frequently had to be supplemented by carbon in the end.

Mr. Sigworth related experiences with powdered carbon applied to the surface of reservoirs of non-filtered water supplies, the recommended quantity being 5 to 25 lbs. per m.g.—this because 60 lbs. m.g. was required before being detected in a drinking glass of water.

In reply to questions, Mr. Sigworth said that in applying carbon from a boat to the reservoir surfaces, it was necessary, as in other applications, to see that the carbon was thoroughly wetted to preclude floating and insure maximum distribution and adsorption. This could be accomplished best in plants with a dry feeder equipped with an injector. In boats, a suspension in barrels served, provided it was kept agitated during the feeding. He recommended that treated reservoirs be held out of service 24 to 48 hours if permissible, although at Washington, Pa., where chlorine was applied to kill algae and activated carbon (30 lbs. per m.g.) thereafter, the reservoir had been out only during one night. No ill effects had resulted. In one case where night bathers had been using a reservoir some dry carbon was broadcast over the surface. This film of floating carbon quickly discouraged bathing.

Pipe Linings

"Pipe Linings," by THOMAS F. WOLFE, Research Engr., Cast Iron Pipe Association, Chicago, Ill.

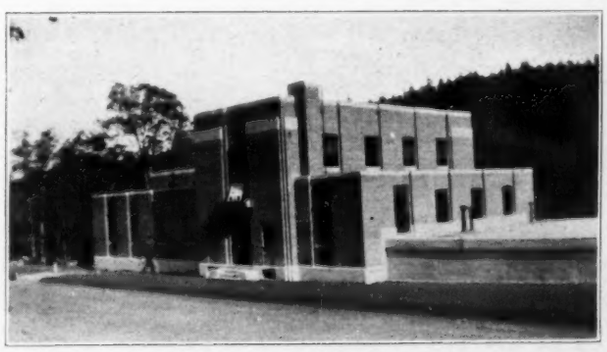
At this stage when much discussion is centering around the high cost of water-main tuberculation, and methods of its prevention, the discussion of "Pipe Linings" by Mr. Wolfe was particularly timely and interesting. He discussed the influence of water quality in tuberculation and exhibited a map showing tuberculating water areas and the influence of mineral content and pH value of waters in the tuberculating and non-tuberculating areas. He also stressed the fact that there were exceptions in each area and only the quality of the local water would disclose in each instance what the expectancy might be. With such knowledge, lined pipes, chemical treatment of the water or both might be justified as preventative measures. If the water dissolved powdered calcium carbonate (limestone) it was considered a tuberculating water. By adding sufficient alkali or lime tuberculation could be checked and a film deposited on the walls.

As to linings, Mr. Wolfe said that cement had been advocated about 100 years ago but the ease and economy of the bituminous dip, and its seeming effectiveness at the time, was taken as the substitute. The light coat of tar had not proved sufficient for all conditions, whereas, cement-linings had stood the test. So impressive was the effect that centrifugally-spun linings of cement, applied at the foundry, had been perfected now to the point where these were considered reliable and dependable—thanks to the insistence, and assistance, of Jas. E. Gibson, Water Works Manager of Charleston, S. C., and experimental research by pipe manufacturers. Concerning the value of cement-linings to future generations, it could be safely assumed that friction would be held constant with increasing age of pipes and a coefficient of "C" = 140 could be depended upon for the life of the pipe. Thereby, would a 6-inch or 8-inch fire service be as valuable to succeeding generations as to the present. Thereby, would pumping be as efficient and economical generations hence as now. Mr. Wolfe cited concrete cases to show the economy in pumping operations as against the added cost of lining at $900 per mile for a 12-inch main. In 2 years, with current at 1 cent per k.w.h., the reduction in power bills had paid the extra cost of the lined pipe used. With a surmise as to tuberculating qualities of a water and predictable continuous low friction coefficient of C = 140 engineers could quickly determine the economics of the extra cost of pipe linings for pumping mains. The distribution system design had other aspects than pumping costs to be considered—notably, sustained service pressures and satisfactory fire capacities with smaller diameter lined pipes than considered safe practice, heretofore, when installing unlined pipes.

Mr. Wolfe summarized by saying that 25 per cent of the area of the United States was affected with tuberculating waters and had the problem to deal with; chemical treatment seemed a satisfactory corrective whereas the use of lined pipe (cement or bituminous coating) was a secure alternate and dependable for a hundred years if not longer. The economics were plain where power costs could be reduced or where safety in design could be met with a smaller, more dependable, less expensive main.

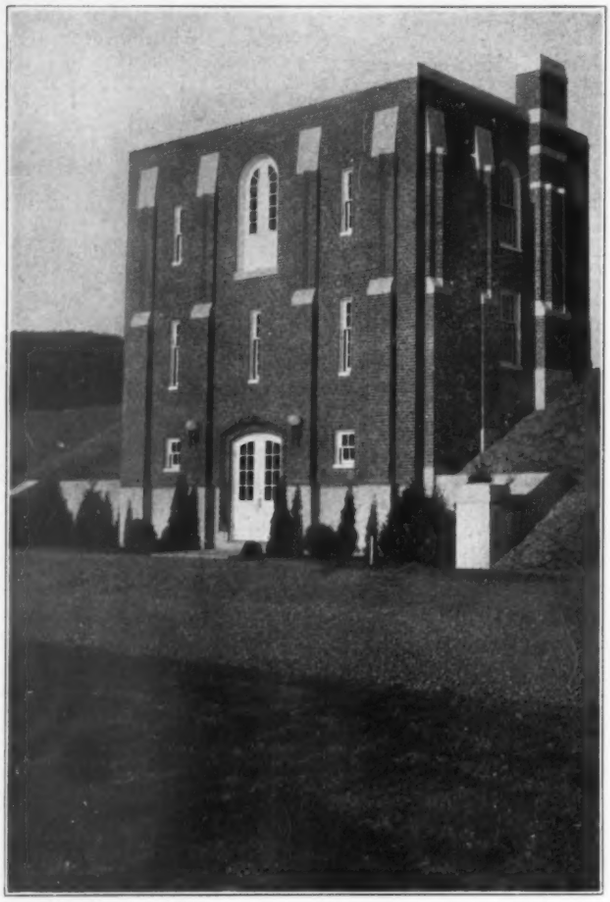
In reply to questions, Mr. Wolfe said that tightening up of specifications covering the cement and the mortar mix had materially improved cement linings and reduced the soluble free lime content, which had caused New York and other cities to apply an impregnating asphaltic seal-coat over the cement. Fittings were cement lined by hand, several mortar coats being applied by brush in earlier practice. Some flaking off of linings when exposed to frost action had been the result. Now the practice was to apply heavier coatings to fittings, thus eliminating the lamination effects.

E. T. CRANCH, Manager, New Rochelle (N. Y.)



Leominster's New Filtration Plant, Built with Relief Labor

* Ill at Home, His Friend and Boss Percy Shaw, Did the Pinch Hitting for John on the Program.



Greenfield's New Filtration Plant. (A Relief Project Which Already Has Proved a No. 1 Investment)

Water Company, said that he had used cement-lined pipe for the past 8 years, the chief complaint being the soluble lime and necessity for use of a seal-coat sprayed on. The improved specification he hoped would eliminate the necessity of the seal-coat.

D. A. HEFFERNAN, Sup't, Milton, Mass., long an advocate of lined pipes, said that, according to his experience, the smaller the pipes the stronger the argument for protective linings. In answer to a question: He had not experienced a single failure of lining due to the leaching out of lime salts or cement. Cement-lined pipe could be cut with a dog chisel without damage to the lining.

ROGER G. OAKMAN, Sup't, Needham, Mass., cited the case of a recently laid 4-mile main involving "Bitumastic" lining. Without the lining, a 16-inch main was required, but a 14-inch lined main proved cheaper and had the capacity of a 16-in.

STEPHEN A. TAYLOR, Sup't, New Bedford, Mass., told of their project, involving the cleaning and cement lining of an 8-mile 48-inch riveted steel main. Results could not be cited because the revamping work was still in progress. Although the lining was 1¼ inches thick, a higher capacity was anticipated than that of the main when new.

M. E. QUIRK, Foreman, Peabody, Mass., in relating their recent experience wherein Fire Underwriters insisted on the cleaning of a 90-year-old 6-in. main, said that he then realized the value of lined pipes. (The speaker might likewise have added that his experience was a demonstration of the fact that "a stitch in time, etc.," applied in water main cleaning as in many other maintenance problems. If more water mains would stop up tight there would be more economy and less risk in water works operation. This, because action would become imperative in the recovery of main capacity and pumping economy and, thereby, a long postponed cleaning operation.—Ed.)

"Free Water"

Members and guests of N.E.W.W.A. were given a treat in the form of that mirth provoking dissertation on the topic "Free Water" (or, "God's Gift," we might add), which was presented with much feeling by J. McClure Wardle, Hudson's (N. Y.) Superintendent of Public Works.

Due to tears of laughter from the eyes of this reporter the notes taken are dimmed and the pen is not capable of reproduction of the pathos and the humor of the oratory. Suffice it to say, that the speaker related the dilemma of a water superintendent who is operating a fully-paid-for system on mostly a free water basis, because of the slogan that "Water is God's gift and should be free!" Repeatedly the superintendent had been before the Water Commissioners to win them over to his argument for a sound rate schedule and at least some metering. Only, to find later that the voting machines are better arguers any day than a mere superintendent. The result is that water users, both domestic and commercial, pay mostly nothing. In consequence, the department is run on a shoe-string, some bailing-wire, a brace with a single bit, a borrowed ammoniator and a home-made pitometer tube (for which the lack of $15.00 leaves uncalibrated), plus the good-will of The Pitometer Company and a chlorinator manufacturer.

In reading the inventory of the shop, Mr. Wardle stopped at Brace —1; Bit —1 (⅞ in.), to explain that the Hudson Water Department was apparently "standardizing"—on one size of hole. (From the heavier technical papers and discussions Mr. Wardle's "act" was a real respite—a divertissement enjoyed by all. May there be more like it to leaven the serious side of technical meetings.—Ed.)

"A Slow Sand Filter Built by F.E.R.A. Labor," by HAROLD L. FIELD, Engr. and Sup't, Water Department, Greenfield, Mass.

Mr. Field in an illustrated talk described Green-

(1) *John Warde (the Transportation Committee)*; (2) *Supt. Geo. Merril, Ware, Mass.*; (3) *Mgr. Frank Henshaw, Scarsdale, N. Y.*; (4) *Comm. E. C. Sanderson, Winchester, Mass.*; (5) *Supt. W. T. Thrasher, Mamaroneck, N. Y.*; (6) *Engr.-Mgr. Arthur Clark, Morristown, N. J.*; (7) *Proportioneers' Smiling Jeff Corydon*

Snapped on the Boat

(1) *Mrs. Fred Stuart, Mrs. Ellis Phelps and Ellis;* (2) *Mrs. P. S. Wilson and friends;* (3) *Fairhaven's (Mass.) Gidley;* (4) *Hope, Ethel and right-to-be-proud Charlie Richardson, their Daddy;* (5) *If ever forgiven, this is Mrs. Harry U. Fuller and the new President caught off-guard*

field's new filtration plant designed by Weston and Sampson and put under construction as a F.E.R.A. project January 2, 1935, and completed 9 months later. The project consisted of a 20-in. C. I. supply main; a 2. m.g.d. slow sand filter plant with 2 filters of 0.2 acre-area each; two coagulation basins and a 500,000-gal. clear well. The plant was placed in operation November 1, 1935, and during only two brief periods since has the addition of 100 to 185 lbs. of alum per million been required.

The construction of pipe lines and installation of equipment was done by Water Department employees and all key men were directly employed by the department. The cost of the 20-in. main was $40,000 and the plant $136,000 of which $98,483 of the $176,000 total was supplied for labor by F.E.R.A. Mr. Field said that the cost of operation had been less than $1,000 per year; that within a year this had been offset by $3,000 savings in the reduction of pumpage formerly necessary during turbid water periods—thus establishing confirmation of the wisdom of the undertaking.

"A Rapid Sand Filter Plant Built by W.P.A. Labor," by W. GUY CLASSON, Sup't and Registrar, Water Department, Leominster, Mass.

Mr. Classon utilizing motion pictures, made by himself described Leominster's new 2 m.g.d. rapid-sand filter plant started as an ERA and completed as a WPA project which had constituted a long and tedious experience, top heavy with supervision but completely supervised as to construction. In all, however, Mr. Classon believed, now that it was all over, the game worth the candle none the less. At the same time a sewage treatment plant was being built, as another WPA project.

The total cost of the filter plant (completed) to the city was only $70,000, and the Federal grant ran to $105,327.

Round Table Topics

"Street Mains and Services"—Leader—SAMUEL H. MACKENZIE, Engr., and Sup't, Water Department, Southington, Conn.

Unable to attend, Mr. Carley of the Southington Water Department, presented Mr. MacKenzie's prepared discussion which concluded that lined pipes should be used more generally and more care should be taken to determine the correct size of service pipes. In his opinion nothing smaller than 1¼-inch pipe should be used if of galvanized iron. He was of the opinion that nothing smaller than ¾-inch copper tubing or red-brass pipe should be used and preferred 1-inch red-brass pipe to the use of copper tubing. He said there was something to be said in favor of straight red-brass service lines against the crooked tubing line. Mr. Hauck (Pitometer Company) felt that the smooth bends of tubing would not create friction losses greater than the straight pipe. Mr. Heffernan (Milton, Mass.) thought ⅞-inch cement-lined pipes sufficient up to 70-ft. runs. Mr. Fuller (Portland, Me.) considered ¾-inch copper O. K. up to 200 ft. Mr. Hawley (Wilkinsburg, Pa.) said that ¾-inch services had proved sufficient with pressures of 130 lbs. and above, whereas, ½-inch was O. K. with pressures above 175 lbs. Concerning meter sizes, it was difficult to convince customers that a ¾-inch meter was frequently sufficient size for a 3-inch service line.

"Factors that Determine Proper Size of Street Mains and Service Pipe"—Leader, ELSON T. KILLAM, Cons. Engr., New York City.

Mr. Killam pointed out that the pressure available at the street main, length of run and quality of water constitute the three factors which determine the size of service pipe. With pressures of 60 to 75 pounds no less than a ¾-inch service should be installed and a 1-inch line was safer. Since the cost of the pipe and fittings involved such a minor portion of the total cost of installation, and since complaints of deficient service (pressure) and the consequent reduced sale of water were important, and replacements expensive, it was not sound economics to use any but the best of materials in ample sizes. Water companies considered this a paying practice. Certainly the service pipe should be amply large to permit draught of 20 gals. per minute with a residual pressure of 15 pounds.

In connection with selection of service pipes Mr. Killam called attention to the valuable studies reported before the Indiana Section of A.W.W.A. by Messrs. H. W. Niemeyer and J. A. Bruhn of the Indianapolis

Snapped on the Boat

(1) *"Northrop and Son," Mrs. Northrop;* (2) *E. T. Killam, "Selling" the President (left) on something;* (3) *Boy, that was a good one;* (4) *Geo. McKay has Sid Wilson thinking hard about what?;* (5) *Scarsdale's Henshaw points out Manhattan's biggest or best "something or other"*

Water Co. An example of the folly of a pinch-penny procedure in service installations was their finding that with the cheapest materials the cost for a ⅝-inch service had been $6.00 less than the most costly used. The folly was shown in the fact that the $6.00 cheaper service caused a pressure loss of 111 lbs.; the most costly only 29 lbs. loss.

In considering street mains, Mr. Killam pointed out that, when new, one 6-inch main is equal in capacity to almost three 4-inch mains; an 8-inch main to two 6's; a 10-inch to almost two 8's, or to four 6's. With increasing age the differences become even wider, and an 8-inch main might readily become equivalent to a 6 in but a few years. This would occur with tuberculation sufficient to cause the friction losses to mount and capacity to drop 40 per cent in consequence. Thus the value of "grid-ironing" and pipe linings was evident.

"Rigid vs. Flexible Service Connections"—Leader, ARTHUR C. KING, Sup't, Water Department, Taunton, Mass.

Here was a lively discussion, heated in spots, which had to be cut off, for renewal at a later meeting, because of lack of time. Mr. King introduced the topic by saying that the use of lead goose-necks at the main required special precautions in making the wiped joint and many opportunities for leaks. The subsequent crystallization of the lead resulted in cracks or splits and gave much trouble, many leaks. Corporation cocks gave trouble if not screwed in to project beyond the pipe wall. Jointing of dissimilar metals produced deteriorating galvanic action. Copper goose-necks were superior in several respects but all-in-all, the rigid service connection was preferred for the reason that there were less joints and a continuous straight run of similar material from cellar to main, thus, reducing friction and facilitating cleaning. To attain this it was only necessary to make a side wall tap in the main. To avoid leaks from strain or settlement it might sound difficult to provide dependable support. However, in Taunton rigid service connections, standard for the past nine years, had given no trouble from deficient support—only one leaking connection being discovered. In Taunton they had standardized on red-brass pipe and fittings straight through to the corporation cock.

Chief Engr. HARRY U. FULLER (Portland, Me.) had satisfactory experiences with rigid red-brass services but used a short length of copper tubing (goose-neck principle) at the main to absorb any possible strain.

Supt. PERCY A. SHAW (Manchester, N. H.) having nothing good to say for splitting lead goose-necks has been substituting copper tubing as rapidly as practical.

Supt. D. A. HEFFERNAN (Milton, Mass.) for 40 years a plumber and water superintendent, had no fault to find with lead if the proper weight was used. In some detail he discussed weights and qualities of lead pipe to use. He couldn't see the rigid service idea when considering the likelihood of strains and breaks. Lead goose-necks and 1-inch cement-lined pipe could be guaranteed as a 60-year service in Milton.

Asst. Mgr. DONALD CALDERWOOD (Nashua, N. H.) had found rigid services satisfactory. It was no trick for "the boys" to bend the pipe sufficiently to line it up without strain. For Mr. Heffernan's benefit, he said that it was surprising how cement-lined service pipe could "take it" when putting a bend in it. When the required bend was marked, red-brass pipe was substituted.

(Nothing being said concerning expansion and contraction of the 100 per cent rigid service, apparently this is not a problem on moderate service runs—and on long runs a friction type coupling will serve as the expansion joint.—Ed.)

"G-Men of the Water Works"

"Meter Masters—the 'G.-Men' of the Water Works"—In introducing this, the closing topic of the convention, Mr. Esty described the sleuth like "Meter Master" as the instrument, when attached to the water meter, left nothing untold in recording what was going on on the customer's side of the meter at every minute of the day. So much about family habits and wasting consumers could be learned from the chart record of the "Meter Master" that little was left for a complaining customer to do but pay up. Lots of fun too—he added. On the other hand it had been good for the customer in showing him how to stop waste, how to reduce extravagant use of water. Also, good for the water utility in determining the most appropriate size of service line and meter to give satisfactory but accurately measured service.

First listed on the program to contribute experiences with the "Meter Master" was JOHN H. READ, Ass't Sup't of the Manchester, N. H., Water Department. For Mr. Read, ill at home, his boss, Percy A. Shaw, General Sup't, did the pinch hitting. Mr. Shaw briefly described the economical readily portable "Meter Master" as an instrument, designed by a water works man for water works men, for attaching to a meter register-shaft without interruption of service. Its claim for distinction was its function for revealing *rates* as well as total volume. The routine use of the instrument, in the hands of meter readers, had been the perfect answer to complaints. Its use had disclosed much valuable information, the use of which had resulted in the replacing of most 3-inch meters with 1 or 2-inch meters, and ¾ with ⅝-inch meters. If earlier available much money invested in meters would have been saved by Manchester. The tell-tale "G-Men" had proved wastage, saved the customer money, brought good-will, as well as more income into the water department. The latter,

More Groups Seeing Manhattan Island

This time we leave you to do the picking. We recognize Sparling's Sparling; Thompson's Thompson; Manchester's Shaw; Weston's Sampson; Melrose's (Mass.) Miller; Maynard's (Mass.) Naylor; Mr. and Mrs. Kerslake and Pa. Water Co.'s Hawley; Oh, Yes! and the accordion player

by more accurate metering of large services and reduced meter investment.

From Hartford, Conn., the home and birthplace of the Meter Master, came HAROLD W. GRISWOLD, Deputy Chief of the Hartford Water Bureau, to tell of some interesting records of compound and battery meter behaviorisms and accuracy, in actual service, as revealed by the "Meter Master." Also, the characteristics of 24-hour and 7-day demand loads of important services, about which little was previously known concerning peak demand rates and sustained rates. In one case the compound meter in service was proved correct in size and missed only 3 per cent of the water passing. The battery meter installation proved of equal if not superior accuracy. In another case the compound meter showed 99 per cent accuracy but a smaller size was indicated. In comparison, the 3-meter battery proved only 95 per cent accurate. In another instance, where consumption rate varied only 3 to 1, the compound meter proved 100 per cent accurate as against 97.5 per cent for the battery. The test showed, however, that a smaller compound meter was ample.

Mr. Griswold's data and curves constituted readily understood pictures of what tests run on important meter installations can reveal with the "G-Man" put on the job 1,440 minutes a day. He felt that, from these data, it could be said that with the proper selection of compound meters for the particular service, with due regard to the change-over point, this class of meter should register 2 to 5 per cent more water than a battery meter installation. The highly unpopular "Unaccounted for Water" figures in every water works office could, without much question, be materially reduced if a closer check-up was made of heavy duty meters and the most appropriate meter used for the service in question. In this direction the "Meter Master" had much of usefulness, in addition to its very helpful detective work on customers' complaints. He cited an interesting case, solved by the "G-Man," wherein a wealthy customer's gardener was finally put on the spot and confessed.

President Esty closed the symposium by adding some of his experiences, in which he has been able to save money for customers; others, where the Water Department benefited. Answering one complaint the housewife was asked, "How many times would you think you or your family draw water in some form each day?" She couldn't estimate so the "G-Man's" record cleared this up—168 times. She "couldn't believe it"—so, paid the bill. To another complainant—"Mr. Smith, who uses three times as much water, taking a bath about 5:30 p. m., than anyone else in your house?" "Why that's that boy of mine, Johnnie." "Just like his Mother, extravagant; *I'll* take care of that!" "Who got up at 5 o'clock and flushed the toilet twice?" "Guess that was me." "Must have had guests for dinner yesterday, Mr. Smith; used lots of water washing and rinsing the dishes." "For a fact, we did have guests Mr. Esty." "Was it you, Mr. Smith, who let the water run 10 minutes while shaving?" "Yep, I guess that was me, too!" "Say; what did you tell me was the name of that dang-busted machine you put on my meter?"

(To be continued)

(In our next issue will appear a digest of papers presented by Joseph Goodman, and Walter E. Spear, on the New York Water System, existing and projected; by W. W. Moorehouse, on the Dayton, Ohio, Water Works System; papers by F. E. Hale, John R. Baylis, H. S. R. McCurdy—constituting a Symposium on Water Treatment and a Symposium on Experiences and Lessons from the 1936 Floods.—Ed.)

Penna. Water Operators Meet at Allentown

The Fall Sectional Meeting of the Penna. Water Works Operators Association was held at Allentown, Penna., September 17. Starting at 1:30 p. m., it ended with an excellent dinner attended by 134 members and guests.

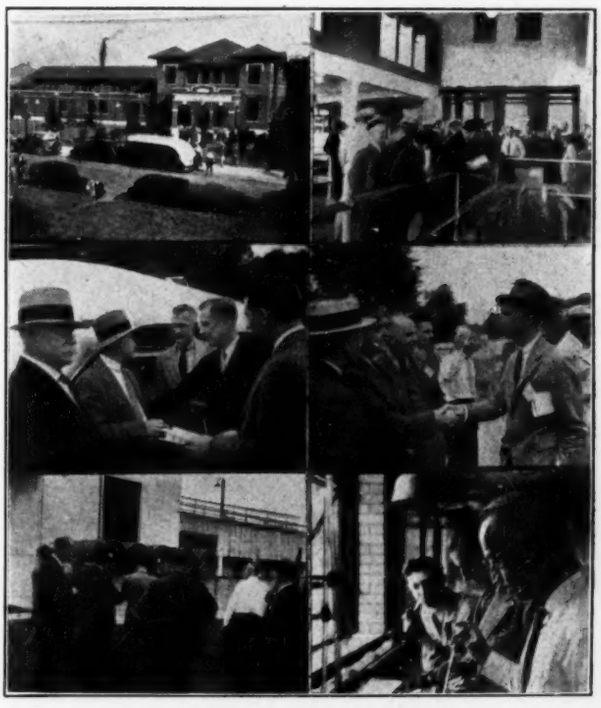
The afternoon was devoted to an inspection of Allentown's Sewage Treatment Works and Water Filtration Plant under the guidance of Harry J. Krum, Chemist in Charge, and his capable assistants. At the filtration plant a feature was the "Floating Laboratory" demonstrated, on invitation, by Fred Stuart, President, Activated Alum Corporation.

Many items of interest were on display, or demonstrated, at the filtration plant by Mr. Krum. Amongst these were the new Thwing Electrometric pH Recorder; a "Duriron" injector arrangement, of his own design, for cleaning and sterilizing filter beds systematically by an injection of chlorine water, followed by a soaking period and washing; a Simplex Sand Expansion Indicator, now under development at Allentown; many laboratory "gadgets."

Following the plant inspections a caravan of about 50 cars carried the group to the 10 m.g. East Side Reservoir (under construction), and thence through Allentown's attractive (water works owned) park along the banks of the Little Lehigh; thence, through Spring Brook Park and to the Trexler Game Preserve, famous for herds of elk and buffalo—the latter, said to be America's largest.

The meeting closed with an illustrated lecture and demonstration of the "Use and Value of the Microscope," by John J. Shank, Director of Wayne Laboratories, Wayne, Pa.

It is regretted that space available fails to do deserved justice to this very excellent and enjoyable meeting, so ably arranged by Messrs. Schnabel and Krum.



Snapped at the Meeting

Top: Filter Plant and Floating Laboratory; Filter Washing. Bottom: At the Sewage Plant; "Prof." Krum Demonstrates

THE CORROSIVE ACTION OF VARIOUS TYPES OF WATER ON HOUSEHOLD PLUMBING

By CHARLES P. HOOVER
Supt., Water Softening and Purification
Columbus, Ohio

In an effort to check actual happenings in the way of corrosion of household plumbing, against assumptions on which chemists are basing the treatment of waters to prevent corrosion—chiefly pH adjustment as the mode—Mr. Hoover has discovered some upsetting results that bid fair to change certain axiomatic beliefs now held by most water works chemists and managers.

In agreeing to contribute the present article, the author at first refused on grounds that the findings, from his very practical attack in testing for the "every-day" type of corrosion, were so far out of line with generally-accepted theoretical expectations as to justify confirmation before release.

In the end, after considerable persuasion, Mr. Hoover agreed to release the Columbus findings, provided the article presented be in the nature of a progress report, carrying tentative conclusions only. It is so presented, with a realization that the findings may prove too timely and helpful to water works chemists and too important to the pocketbooks of many to justify withholding until completion of the work some time hence.

In this light, the author presents this article as one relating progress and tentative conclusions, subject to further tests in the continuing experiments and study.—Editor.

IT IS generally accepted that the higher the pH. of a water, the less corrosive it will be to iron. Further, that the corrosive action depends upon the oxygen content, other things being equal.

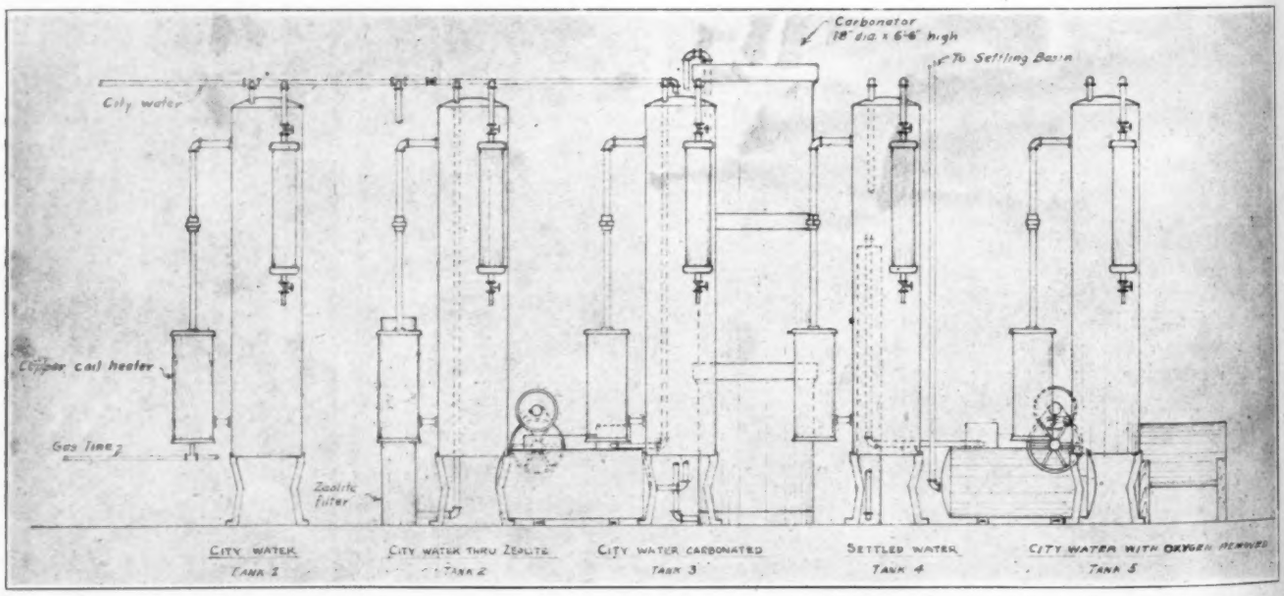
C. P. Hoover

Results of experiments over a period of one year at the Columbus Water Softening Plant, indicate that these axioms (now almost considered laws) may not hold true in the case of corrosion of galvanized hot water heating tanks. An example which indicates that low pH water may be less corrosive to galvanized iron hot water heating tanks than high pH water, may be seen by examining the accompanying photographic exhibits. The tanks cut in half and photographed are numbered 1, 2, 3, 4, 5, and 6.

Test Experiments

Hot water, approximately 155 deg. Fahr., was passed through the tanks continuously for one year. Columbus' softened and pH adjusted tap water, with an average total alkalinity of 32 ppm., a phenolphthalein alkalinity of 13 ppm. and a pH of 9.3 was passed through Tank No. 1. It was *badly pitted.*

Tank No. 3 on the other hand, was operated right alongside of No. 1, the only difference being that the



Experimental Test Arrangement to Study Corrosion of Household Piping and Hot Water Tanks at the Columbus, Ohio, Plant

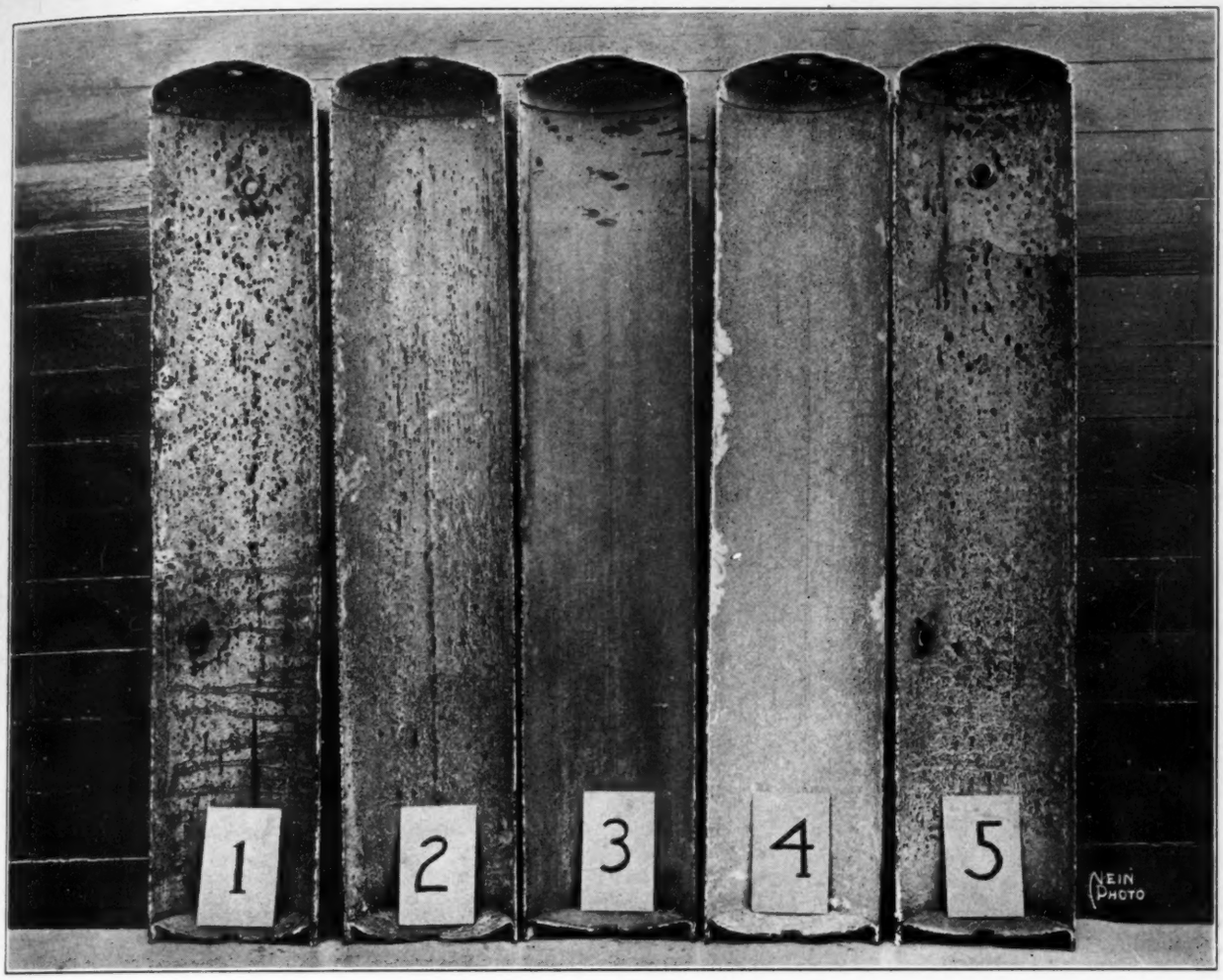


Exhibit 1—What Happened to Household Hot Water Tanks During One Year of Service on Columbus Water Variously Treated

water going through No. 3 was more thoroughly carbonated than the water in No. 1. It was city tap water with enough additional CO_2 added to convert all the normal carbonates to bi-carbonates. It had a total alkalinity of 42 ppm., a phenolphthalein alkalinity of 0, free CO_2 7 ppm., and a pH of 7.5. As the picture (Exhibit 1) indicates, there was *little or no pitting.*

With one exception, the whole series of experiments which have been run during the past year, to determine the corrosive action of the various types of water on household galvanized hot water heating tanks, worked out differently from anything anticipated and in accord with accepted theories concerning corrosion control in municipal water treatment practice.

The work was originally placed under the direct charge of Mr. Norbert Koebel, a senior in the Chemical Engineering Department at Ohio State University. Mr. Koebel made a progress report for Prof. James R. Withrow, head of the Chemical Engineering Dept. at Ohio State University on June 6, 1935, which he submitted as a thesis for the degree of Bachelor of Chemical Engineering. Since September, 1935, the detail work in connection with the operation of the experiments has been carried on by the plant's assistant chemists, Messrs. Harper, Goldfrederick and Schenker.

The equipment upon which the corrosive tests were conducted, consisted of six 30-gallon capacity, first grade galvanized iron hot water tanks.

These tanks were of the standard type used in the average home for water heating. They were operated for a period of one year, and in a manner so as to simulate, as nearly as possible, household conditions. Ten gallons were drawn out each morning, 5 gallons at noon and 10 gallons again at night.

At the end of the year the tanks were cut open vertically (see Exhibit 1) and a study was made of the nature of the coatings, pittings and tuberculations. Photomicrographs were made of sections of the thickness of the tanks at several points in each tank to determine the amount of dezincing and nature and depth of the pitting and tuberculation. (Exhibits 2, 3, 4, 5.)

DETAIL OF EXPERIMENT

(Results in parts per million)

Tank No. 1. *Water Used—City Tap*

	Water entering tank			Water leaving tank
	Max.	Min.	Ave.	
Alkalinity (Methyl Orange)	78	22	32	31
Alkalinity (Phenophthalein)	61	4	13	17
Alkalinity (Caustic)	44	0	0*	3
Hardness	137	61	86	86
Dissolved Oxygen	..	..	7.7*	1.7*
Free CO_2	..	..	0	0
Zinc	..	..	0	14.6*
Iron	..	..	trace	0.48
Alkalinity ($CaCO_3$ added, then filtered)**	..	..	28*	32*
pH	10.4	8.4	9.3*	8.8*

*Important to note. **Well-known Marble Test.

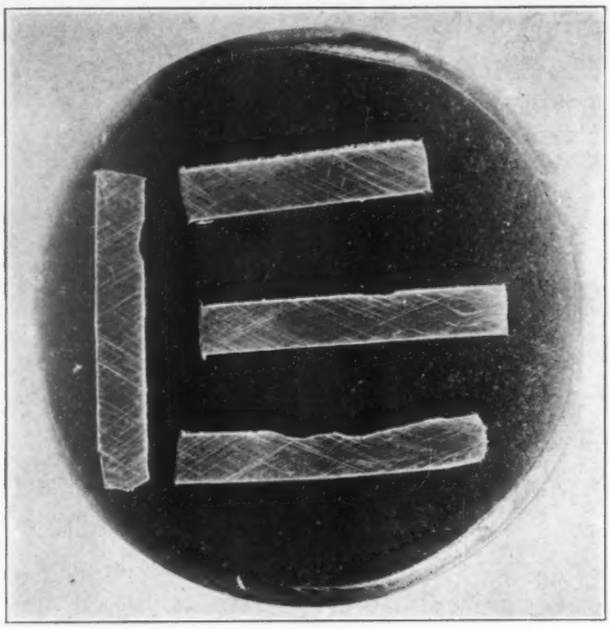


Exhibit 2—Photomicrograph of Wall Section Tank No. 1. (Compare with View of Tank Interiors.)

Tank No. 2. Water used—City Tap, passed through Zeolite softener

	Water entering tank	Water leaving tank
Alkalinity (Methyl Orange)	38	37
Alkalinity (Phenolphthalein)	12	11
Alkalinity (Caustic)	0	0
Hardness	19	22
Dissolved Oxygen	8.2*	1.8*
Free CO_2	0	0
Zinc	0	10.8*
Iron	trace	0.35
Alkalinity ($CaCO_3$ added, then filtered)**	42*	44*
pH	9.1*	9.1*

*Important to note. **Well-known Marble Test.

Tank No. 3. Water used—City Tap plus CO_2

	Water entering tank	Water leaving tank
Alkalinity (Methyl Orange)	42	41
Alkalinity (Phenolphthalein)	0	0
Alkalinity (Caustic)	0	0
Hardness	94	90
Dissolved Oxygen	7.8*	2.7*
Free CO_2	7.0*	3.9*
Zinc	0	19.0*
Iron	trace	0.89*
Alkalinity ($CaCO_3$ added, then filtered)	49*	48*
pH	7.5*	7.5

*Important to note.

Tank No. 4. Water used—Lime softened, uncarbonated water

	Water entering tank	Water leaving tank
Alkalinity (Methyl Orange)	53	45
Alkalinity (Phenolphthalein)	36	27
Alkalinity (Caustic)	19	11
Hardness	94	94
Dissolved Oxygen	7.8*	2.1*
Free CO_2	0	0
Zinc	0	20.3*
Iron	trace	trace*
Alkalinity ($CaCO_3$ added, then filtered)	33*	26*
pH	10.1*	9.9*

*Important to note.

Tank No. 5. Water used—City Tap, plus addition of Na_2SO_3 to remove Oxygen

	Water entering tank	Water leaving tank
Alkalinity (Methyl Orange)	35	36
Alkalinity (Phenolphthalein)	11	7
Alkalinity (Caustic)	0	0
Hardness	87	89
Dissolved Oxygen	2.3*	0.7*
Free CO_2	0	0
Zinc	0	14.1*
Iron	0.24*	0.35*
Alkalinity ($CaCO_3$ added, then filtered)	31*	34*
pH	9.0*	8.8*

*Important to note.

Tank No. 6. Operated in a home in Lancaster, Ohio. *Water used—Well water, softened through Zeolite only*
(Analysis of water at Lancaster, July, 1936)

Alkalinity (Methyl Orange)	293
Alkalinity (Phenolphthalein)	0
Hardness	86
pH	7.3

Depth of Corrosion Pits

The study of low magnification photomicrographs revealed the depth of corrosion pits. Sections of metal were cut from each tank, one from the upper half, one from the middle and one from the lower half of the tank. From these sections pieces were selected and cut so as to obtain the deepest rust spots. The cross sections of the samples were mounted in Bakelite and polished for the microscopic photographs. (See Exhibits 2 and 3.) This work was done by Mr. Koebel in the Laboratories of the Batelle Institute in Columbus, Ohio.

The following depths of pits were noted:

Tank No. 1.....0.67 mm.
Tank No. 2.....0.58 mm.
Tank No. 3.....No Pits
Tank No. 4.....No Pits
Tank No. 5.....0.83 mm.
Tank No. 6.....1.00 mm.

Original Zinc Coating

Studying the photomicrographs indicates that 0.10 mm. was the original thickness of the zinc coating. (See Exhibits 4 and 5.)

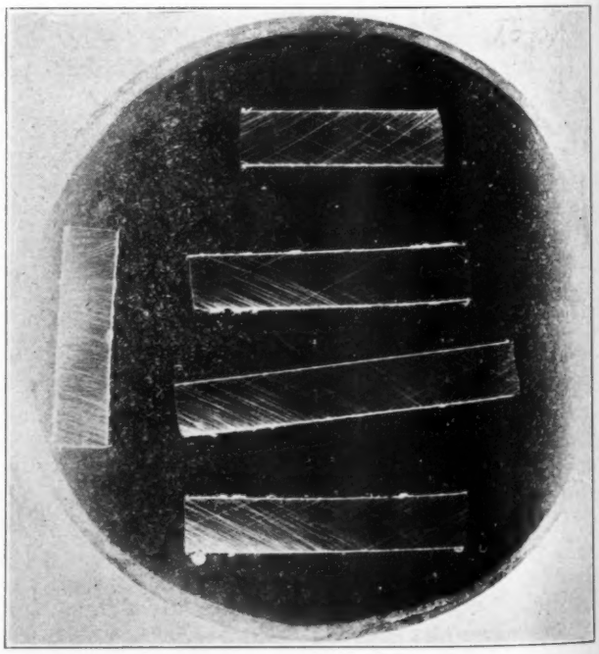


Exhibit 3—Photomicrograph of Wall Section Tank No. 3. (Compare with View of Tank Interiors.)

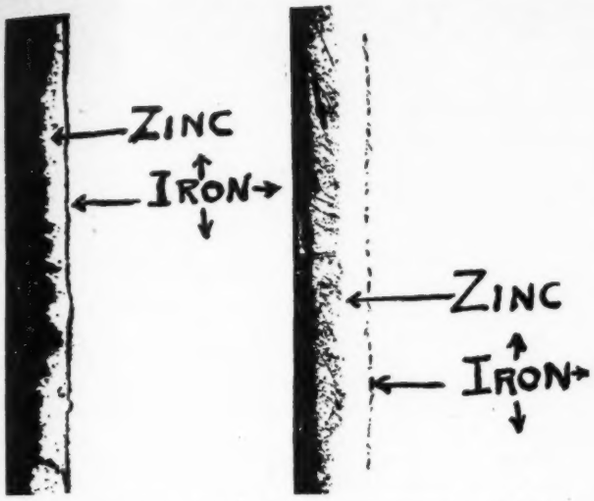


Exhibit 4 (*Left*) *and Exhibit* 5—*Microphotographs* (100 *Diameters*) *of Wall Sections Showing Residual Zinc Coating Tank No.* 1 (*Left*), *Tank No.* 3 (*Right*)

An interesting feature of the photomicrographs was the presence of some pin holes in the zinc coating, suggesting an explanation for the formation of rust tubercles and pitting in certain spots and not in others and showing the value of protective coatings only when free from imperfections and weak spots and regardless of their thickness within reasonable limits.

In some spots on Tank No. 1 (not including the rust pits) there was no zinc coating left at all. The microscopic examination of etched specimens from Tank No. 1 showed that what zinc coating remained was that of the zinc-iron alloy at the interface of the two metals. (See Exhibit 4.)

In Tank No. 2 the zinc remaining was somewhat thicker and more uniform than that of Tank No. 1. But, similar to Tank No. 1 most of the zinc coating left was that of the zinc-iron alloy. Many pin-holes through the coating, with the formation of very small rust pits, could be seen.

It could readily be seen in the microphotograph (Exhibit 5) that the water of Tank No. 3 (slightly carbonated water with a pH of 7.5; 7.0 CO_2 and 7.8 D. O.) was the least corrosive to zinc. Only about one-fourth of the zinc coating was corroded away and this was done in a uniform manner. This was representative of all of the samples taken from Tank No. 3 for the micrographic examination.

The zinc coating remaining in Tank No. 4 was much heavier than that of Tank No. 1 and Tank No. 2, and in many places it seemed to be heavier than in Tank No. 3 but not as uniform. In some spots only the zinc alloy remained and in others both the zinc alloy and the zinc were present. A pin-hole in the zinc coating and the formation of a rust pit could be seen in one photomicrograph.

The remaining zinc coating of Tank No. 5 was much like that of Tank No. 1, showing places where there was no zinc coating and others where only the zinc-alloy remained.

The character of the remaining coating on Tank No. 6 (Lancaster water) revealed that some of the zinc coating was rather thick while in some places it was thin and contained many pin-holes.

Discussion of Findings

Tank No. 1—Using city tap water (pH 9.3 avg.), was the most badly pitted.

Tank No. 5—Using water (pH 9.0) from which all but 2.3 p.p.m. of the dissolved oxygen was removed was the next most badly pitted.

Tank No. 6 (Photo not shown)—Lancaster deep well, Zeolite softened water (pH 7.3)* was next most pitted.

Tank No. 2—Using city tap water further softened by Zeolite (pH 9.1—D. O. 8.2) was not as bad as 1 or 5. Zinc in water leaving unexplainably low.

Tank No. 3—Using city tap water carbonated (free CO_2, 7.0 p.p.m.—pH 7.5—D. O. 7.8) showed no rust pits or tubercles. Zinc in water leaving seemed unexplainably high considering appearance of cut tank and micro-section.

Tank No. 4—Using lime softened, caustic, uncarbonated water (pH 10.1—D. O. 7.8) showed no rust pits or tubercles. This kind of water, however, deposits *too* much protective scale. Also showed highest zinc concentration in water leaving of any.

[*Unfortunately the water analysis does not reveal the free CO_2 or the dissolved oxygen content of the Lancaster water. The first may be assumed high, the latter moderate, if not low.—Ed.]

Tentative Conclusions

We hesitate to draw conclusions at this time because our work is not finished. We feel that this series of experiments is just a beginning as far as our laboratory is concerned. Already a much more elaborate series is being run and more conclusive results should be available in the Fall of 1937.

Generally speaking, however, when based entirely on the results from this one set of experiments, we interpret the results as indicating:

(1) That low alkalinity water containing all or nearly all calcium and magnesium normal carbonates, at a temperature of 150 deg. Fahr., is more corrosive to galvanized metal than water containing no normal carbonates, even though dissolved oxygen is appreciable and some free CO_2 is present.

(2) That normal calcium and magnesium carbonates deposit an uneven scale, from 1/32 to 1/16 of an inch in thickness, which is somewhat adherent, whereas the bicarbonates of calcium and magnesium produce a much thinner scale, probably basic carbonate of zinc, which adheres much better to the metal.

(3) That corrosion of zinc depends more upon the alkalinity of pH of the water than upon the dissolved oxygen present.

(4) That the attack of normal carbonate water on the galvanized tank, which brings about failure, starts at the pin-holes or the weak spots in the galvanizing. The water soon eats its way through such pin-holes and then attacks the iron. These pits keep spreading and growing deeper until the tank fails.

(5) That the products of corrosion, produced by calcium and magnesium bicarbonates, fill the pin-holes, thus acting as a protective film.

Acknowledgment.—The above paper, prepared for WATER WORKS AND SEWERAGE, was presented by the author before the 16th Ohio Conference on Water Purification, at Columbus, Ohio, September 29, 1936.

PRACTICAL ELECTRICITY IN THE PLANT

The A. B. C.'s of Electricity for the Water and Sewage Works Man—Article No. 1

By MARSDEN C. SMITH

Engr. Water and Electricity, Dept. Public Utilities, Richmond, Va.

This is one of a series of short articles by Mr. Smith, dealing with the A.B.C.'s of practical electricity for water works and sewage plant operators.

The author is a graduate electrical engineer, converted to a water works operator. He is, thereby, peculiarly well qualified to present these discussions, which should be of considerable benefit to operators and designers less thoroughly grounded in electrical matters.

If there are points in his contributions not clear to the reader, Mr. Smith offers to answer inquiries to the extent of his ability to do so.—Editor.

The Author

THE increasing use of electricity in water and sewage treatment plants produces problems of design, operation and maintenance with which the engineer in charge is generally but little familiar. Fortunately, while advanced electrical engineering is a very involved subject, a helpful and useful knowledge of its fundamental principles can be obtained quite readily by the trained personnel of such plants. To that limited end the presentation of this series of articles is confined.

Electrical Units

The Volt

One of the most important units of electricity is the Volt. It is the unit of electrical *pressure*. Just as we measure water force or pressure in units of pounds per square inch or feet of head, the unit of electromotive (electric moving) force is the volt. In equations, its symbol is E. Voltage is sometimes expressed in print as the emf—abbreviation for electric-motive force.

Standard voltages are 110, 220, 440, 2,200, 4,000, and 13,200. The individual for whom these articles are intended is rarely concerned with voltages in excess of 2,200. Furthermore, the 110 volt standard is now in the process of change, and seems to be quite generally replaced by a standard of 120 volts.

Extra-heavy fittings and greater precautions are necessary with greater water pressures; so too, must greater care be taken both of life and property when higher electrical pressures are used. However, pressures of as little as 110 volts, in common domestic use, may prove fatal and care should always be taken to avoid personal contact with even these relatively low pressure circuits.

Most electrical apparatus is designed to operate at one of the above mentioned standard voltages. The use of other than these standards is both unnecessary and uneconomical. Incandescent lamps are generally rated at from 110 to 125 volts in five-volt increments. They may be obtained designed for 220 volts, but such lamps are not recommended except where no 110-volt service is available. Even then safety and economy demand the use of 110-volt lamps if possible.

Some Practical Considerations

Lamps are very sensitive to voltage change; and the operator should see that the lamps are purchased for the circuits on which they are to be used. For example, if the average voltage at the station is known to be 118 volts, 120-volt lamps should be used. Here the use of 110-volt lamps would increase the lamp replacement cost by almost 300 per cent.

Motors are not nearly so sensitive to voltage change as are lamps and will operate successfully at applied voltages within 10 per cent above or below normal rated voltage. Greater voltage variation will generally cause excessive heating and unsuccessful operation.

Small motors (less than 5 horse-power) are usually single phase and operate at standard lamp voltages. Large motors, 5 to 50 H.P., are cheaper when designed for 220 or 440 volts. Larger than 50 H.P. should be designed for 2,200 volts. Of course, local conditions may change these recommendations. One large plant has motors from 3 to 300 H.P. The station designers used 2,200 to 440-volt transformers; motors between 50 to 300 H.P. were ordered for 440 volts. A second set of transformers reduced the 440 volts to 220 volts for the smaller motors (up to 50 H.P.). Certainly this is unfortunate, because the larger and more expensive motors would have been of less first cost if designed for 2,200 volts, and the 2 to 5 per cent transformer losses, which materially increases operating costs, would have been saved. The smaller motors could all have been 440-volt type, thus here again would have been saved the second transformer losses. Here we see an evident error that a better understanding of the problem of electricity in design would have avoided.

Other than electrical engineers often fear the use of 2,200 volts. It is true, that there is no need for this higher potential, unless the size and number of motors justifies its use. However, where the total of as much as two or three hundred horse-power is required for motors larger than 50 H.P., the higher potentials are certainly advisable.

The relative advantage of the use of 220 or 440 volts as the operating voltage for the smaller motors is not so definite. However, for larger plants 440 volts seems more desirable. Safety requires the same care with 220 volts as with 440 volts, and a much wider range of motor sizes can be more economically operated at this than at 220 volts.

The Ampere

The second important unit of electricity to be considered is the Ampere.

It is the unit of electrical *rate of flow*. We are familiar with the various measures of the rate of flow of liquids; gallons per minute, etc.; so we should think of the unit rate of flow of electricity as the ampere. In equations its symbol is generally (I). In print Amperes are sometimes abbreviated to "Amp." Larger pipes are required to carry larger rates of flow of water economically; so too, larger wires are needed to carry larger currents (amperes) economically. Small pipes may be uneconomical because friction causes too great loss of water pressure. In exactly the same way, wires may be too small for the amperage (current flow) and cause an uneconomical loss of electrical pressure (voltage drop).

There are no standard currents as in the case for the voltage rating of electrical apparatus. Each appliance, lamps, heating devices, etc., takes from the circuit a current dependent upon its design and lack of resistance to flow. Motors require, for example, a current that varies with the load. All electrical apparatus (except lamps) should have its normal current rating stamped upon its nameplate. Lamp current is determined by dividing its watt rating by its rated voltage.

However, there are certain appliances such as wire, fuses and switches that are rated in terms of the current they may safely carry; thus currents are to this extent standardized. The plant manager should realize that these current ratings are fixed by the National Electric Code, and he should not permit greater current to flow through accessories than the limits established by this code. Oftentimes circuits are fused far beyond the rated capacity of the wire, which is supposedly being protected by the fuse. Such practice is both uneconomical and dangerous.

Most appliances, including motors, are connected between the supply lines, that is, in parallel. In this way the circuit voltage is impressed upon each appliance, causing a current to flow through the appliance of a quantity dependent upon its rating and load. These increments of current are added, hence the supply wires carry greater and greater total current as we work back toward the source of power. For example: Five 1,000-watt lamps rated 100 volts each require 10 amperes. Let us designate these as numbers one to five, from that nearest the supply to the most remote. Both wires between the supply and the first (No. 1) lamp carry 50 amperes; between 1 and 2, 40 amperes, and so on until between 4 and 5 the current has reduced to 10 amperes, or that required by No. 5—the last lamp. They all have (practically) the same voltage as the supply applied to their terminals.

Some Practical Considerations

When installing new apparatus there are two considerations of great importance: (1) Use wire of ample conductor size. (2) Employ insulation having a large factor of safety. For low potential circuits (less than 600 volts) 30 per cent pure rubber insulation will generally prove more economical than the standard code insulation. Particularly is this true in water and sewage treatment plants due to the prevalence of dampness in such locations. For 2,200-volt circuits rubber insulated cable is more easily installed than is varnished cambric cables. Rubber depreciates much more rapidly when subjected to heat and grease or oil than does varnished cambric, but it is less affected by moisture. For this reason, varnished cambric is never used without some form of outer coating, usually lead. Modern synthetic resins and other compounds are rapidly proving their value for use as the outer protective coating, materially lessening the installation difficulties. These coatings are deserving of consideration.

In general, where expert electrical maintenance is not available, the proper thickness of 30 per cent pure-rubber insulation, on conductors of adequate size for the current they will ever have to carry, will certainly well repay the increased investment cost. Where such expert maintenance is available, varnished cambric insulation may prove better for 2,200-volt circuits.

The Ohm

The unit of electrical resistance is the Ohm. In equations its symbol is (R).

If we close the spigot, even though there be water pressure at the valve, no water can flow because the resistance is too great. The same result is obtained when opening an electric switch; the pressure (voltage) still exists but the resistance (ohms) become so great that no current (amperes) can flow. This is an example of localized resistance.

Electrical resistance may be distributed, in fact *is* distributed along the conductor just as is the pipe resistance to water flow proportional to its size, length and condition. Fortunately, in electrical circuits the loss of voltage (pressure) is always directly proportional to the resistance and rate of current flow. Therefore, the loss of power (to be discussed in the next article) is proportional to the resistance and the square of the rate of flow or current.

An electrical device, such as a lamp, does not use or destroy current in the sense that an oil lamp consumes oil, but by its relatively high resistance limits the current that may flow as a result of the impressed electromotive force—voltage. Thus we have the simple but important equation known as Ohm's Law:

$$E = RI \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

There are no standards of resistance; however, the established resistance per unit length of electrical conductors and resistance alloys may be found in any electrical engineer's handbook.

Direct vs. Alternating Current

Formula (1) applies to circuits that contain resistance only, or in which the frequency is zero, as in the case of direct current. This term frequency must now be understood. If the polarity between two wires (A and B) of a circuit is not changed, the current flow will always be in one direction in the wires, thus constituting what is termed direct-current—(D.C.). If we alternate wires A and B from one side of the source to the other, once each ½ second, the direction of current flow in A and B will reverse once every ½ second, and will begin to flow in the original or *same* direction in a given conductor once every second. Electrically we would say that there was being produced "An electromotive force (current) having a frequency of one cycle per second." Fundamentally that is the difference between alternating and direct currents. Modern alternating currents closely follow the sine law in their time-potential value; and the standard frequency in this country is now sixty cycles per second.

When direct current is applied to a coil of copper or other wire (having resistance R) wound around iron, if the current and voltage be carefully measured, equation 1 will be found to apply. When an alternating voltage is applied this equation no longer can be used. This is because any magnetic circuit is an inductive

circuit, and the effect of an inductance is to divide the alternating current into two components which are at right angles to one another. Hence to obtain the same current through the coil when an alternating voltage is applied, a greater voltage is required than when a direct voltage is used. So for alternating current circuits equation 1 becomes:

$$E = ZI \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

in which Z is the impedance of the circuit.

Many devices, such as heating appliances and lamps have little or no inductance; hence may be used on either direct or alternating current circuits of the rated voltage; but inductive devices, such as transformers and motors, cannot be used on direct current circuits unless especially designed for the purpose.

Transformers

The engineer for whom these articles are intended rarely is concerned with the use of transformers; however, a brief discussion of them is advisable. The standard transformer consists of two stationary coils of wire insulated from one another and wound around a common iron core. A special class, the auto-transformer, commonly used for motor starters, has only one winding with connections to some desired turn between the two end turns.

Of the winding in the auto-transformers, the turns connected to the power supply is the primary; the secondary winding is connected to the load. The voltage change between the primary and secondary is in direct ratio to the number of turns used in the two windings; conversely, the current is in the inverse ratio to the number of turns. Hence a transformer may be used to increase voltage as readily as to reduce it—the so-called "step-down." Many deaths have resulted from opening the high voltage switch, assuming the transformer "dead," when in fact the 110-volt side was still energized thus producing normal high voltage in the primary.

Instrument transformers are especially designed to accurately reduce the potential or current, as the case may be, for metering and other purposes. Care should be taken to always connect the secondary terminals of current transformers together with wire (short-circuit them) if the secondary circuit must be disconnected for any purpose while the primary continues to carry current.

It is well to know that transformers, if kept cool enough, can safely carry much greater than rated loads. Cold winter weather and artificial ventilation around the tanks is effective, but hot locations and days are dangerous. Tank temperatures should never exceed 90 degrees C. Contamination of the oil by dirt or even traces of moisture must be avoided. In larger units the oil should be examined monthly by a competent inspector.

(The Watt and other phases of power will be discussed in the next article of this series.)

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ASSOCIATION MEETINGS SCHEDULED:

OCT. 13-17—PITTSBURGH, PA.
American Soc. Civil Engineers. A. V. Karpov, Chairman of Local Committee, 801 Gulf Bldg., Pittsburgh, Pa.

OCT. 14-16—ATLANTIC CITY, N. J. (Hotel Haddon Hall).
Pennsylvania Water Works Association. (Annual Convention.) Secretary, F. Herbert Snow, 327 Telegraph Building, Harrisburg, Pa.

*OCT. 15-16—SARATOGA SPRINGS, N. Y. (New Worden Hotel).
New York Section, A. W. W. A. (Fall Meeting.) Sec'y, R. K. Blanchard, 50 West 50th Street, New York City.
*(Dates changed—originally Oct. 22-23.)

OCT. 20-23—NEW ORLEANS, LA. (Hotel Roosevelt).
American Public Health Association. Exec. Sec'y, Dr. Reginald Atwater, 50 West 50th Street, New York, N. Y. Conference of State Sanitary Engineers. Held simultaneously.

OCT. 23-24—ATLANTIC CITY, N. J. (Hotel Ambassador).
New Jersey Water Works Associations. A Joint Meeting of the N. J. Section, A. W. W. A. (P. S. Wilson, Sec'y); N. J. Water Works Association (W. C. Flanders, Sec'y); South Jersey Association of Water Superintendents (Walter Spencer, Sec'y). Chairman of Committee on Arrangements, Prof. H. N. Lendall, Rutgers University, New Brunswick, N. J.

OCT. 26-28—CHARLOTTE, N. C. (Hotel Charlotte).
North Carolina Section, A. W. W. A. Secretary, M. F. Trice, Asst. Engr., State Board of Health, Raleigh, N. C.

OCT. 26-28—KANSAS CITY, MO.
Missouri Valley Section, A. W. W. A. Secretary, Prof. Earl L. Waterman, University of Iowa, Iowa City, Ia.

OCT. 29-31—CHARLOTTESVILLE, VA.
Virginia Section, A. W. W. A. Secretary, H. W. Snidow, Senior Asst. Engr., State Dept. of Health, 601 State Office Building, Richmond, Va.

OCT. 29-30—INDIANAPOLIS, IND. (Antlers Hotel).
Central States Sewage Works Association. Sec'y-Treas., Gus H. Radebaugh, Director, Champagne-Urbana Sanitary District, Urbana, Ill.

NOV. 5-7—MINNEAPOLIS, MINN. (Hotel West).
Minnesota Section, A. W. W. A. Sec'y-Treas., R. M. Finch, 416 Flour Exchange, Minneapolis, Minn. (In conjunction with Municipal Utilities.)

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R. W. Haywood Employed On "Nuchar" Developments

R. W. Haywood

Robert W. Haywood has recently joined Industrial Chemical Sales Company, of New York City (Chemical Division of West Virginia Pulp & Paper Company), to do development work with their well-known product "Nuchar"—the powdered activated carbon which but a few years ago, practically revolutionized taste and odor control methods in the water supply field.

Mr. Haywood it at present devoting most of his attention to the adaptation of "Nuchar" to the treatment of sewages and industrial wastes. In this direction, indications already show that it has merit in improving sludge digestion, reduction of floating solids, odor control at treatment works and in sludge dewatering operations. In addition, it has been reported to produce economy and beneficial effects in chemical precipitation practice in coagulation.

"Bob" Haywood cut his operating "eye-teeth" with North Carolina's Dept. of Health and then as Chemist in Charge of the water purification and sewage treatment works of Gastonia, N. C. Later, and until his present connection, he was Superintendent of Filtration for the Lehigh Water Company at Easton, Pa. His first-hand experience in applications of activated carbon at the filtration plant at Easton and, earlier, in both filtration and sewage treatment at Gastonia, N. C., together with his experimental and research proclivities, will go far toward making his new work with "Nuchar" pleasant and productive.

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50TH ANNIVERSARY OF ENGINEERING INSTITUTE OF CANADA.—The Engineering Institute of Canada will celebrate its semi-centennial June 15-18, 1937, at the Windsor Hotel, Montreal, Que. Invitations have been sent to 75 engineering societies throughout the world.

CALIFORNIA SEWAGE WORKS ASSOCIATION

Inspects Los Angeles City and County Disposal Works

Reported by A. M. RAWN*

AT SANTA MONICA, on September 10 and 11, one hundred and twenty-five members participated in the 9th Annual Conference of the California Sewage Works Association which met with the League of California Municipalities.

Situated in the heart of the Los Angeles metropolitan area, Santa Monica proved an exceptionally satisfactory starting point for the association's customary inspection "caravan" on their first day of meeting. Proceeding from the convention city at 8:30 in the morning, members assembled at Los Angeles' extensive Hyperion Screening Incineration Works located on Santa Monica Bay. Following the inspection the group proceeded to the Joint Disposal Plant of the Los Angeles County Sanitation Districts which utilizes what is basically the activated sludge process and rapid multi-stage digestion tanks, through which solids pass in less than two weeks and from which gas is taken for power production.

Continuing, the caravan advanced to Camp No. 2 on the line of the 6.2-mile tunnel being constructed by the County Sanitation Districts to convey effluent from the joint disposal plant to the ocean outfall at White's Point. The group there were given the opportunity to see the tunnel construction, involving several innovations and new expedients.

Following luncheon in the Palm Gardens, adjacent to the location of the District's ocean outfall at White's Point, an inspection of the ocean pipe line and tunnel construction was made. After this the caravan proceeded to Los Angeles' new Terminal Island Treatment Works and thence to the screening and incineration plant of the city of Long Beach. Returning to Santa Monica the conference was formally opened with the customary annual dinner-meeting.

The Program

As guest speaker, the Honorable A. E. Stockburger, State Director of Finance, reviewed California's financial status and gave the members a lucid and timely explanation of the State's resources and the method and manner in which public funds are tagged and expended by legislative enactments. He indicated clearly the limited amount of money which is available to State agencies for purposes other than for which specifically collected; said that although the biennial budget of the State of California may run into hundreds of millions of dollars, there are but few of those millions over the expenditure of which State officials have discretionary powers. On this score any request for State funds for sewage research or other justified purposes would necessarily feel the influence of the very narrow margin of excess funds which the State may have available for discretionary appropriations.

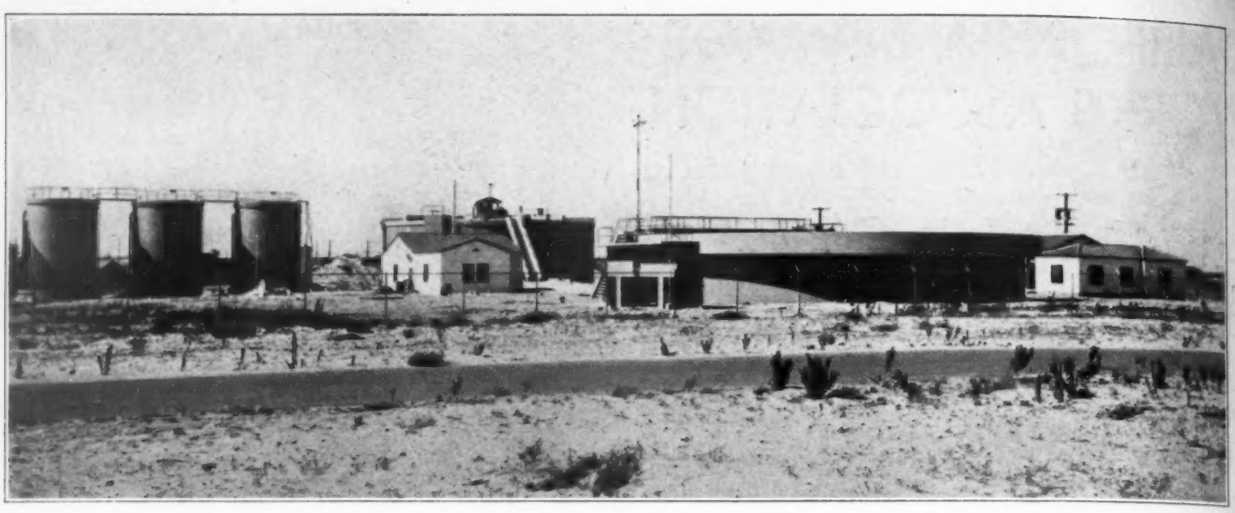
The Hyperion Screening-Incinerator Works at Los Angeles. Screenings Incinerator in Left Foreground

The technical session, the morning of September 11, held in conjunction with the city engineers section of the League was well attended. The first paper presented by C. G. Smith of Los Angeles constituted a brief description of new structures and outlined changes proposed for Los Angeles' extensive sewer system and disposal works. C. C. Kennedy of San Francisco recounted Stockton's proposed plans for the reconstruction of its sewage treatment plants. Motion pictures were then shown by the Chairman, to give a running story of preliminary investigations and construction work upon the County Sanitation District's outfall tunnel and pipe line.

In the afternoon H. N. Jenks of San Francisco presented a comprehensive picture of his applied innovations to the trickling filter and San Diego's assistant city engineer, B. D. Phelps, outlined proposed improvements in sewerage facilities in his city. The meeting concluded with committee reports on operator's schools, voluntary registration of operators, safety regulations for sewer maintenance employees, and proposed and current legislation affecting sanitary works and workers; closing with election of officers for the year 1937.

The following officers were unanimously chosen: President, E. A. Reinke, State Department of Health, Berkeley. 1st Vice-Pres., R. F. Goudey, San. Engr., Water Dep't, Los Angeles. 2nd Vice-Pres., Alexander Bell, Wallace and Tiernan Co., San Francisco. Sec'y-Treas., R. R. Ribald, Engineer, Bureau of Sewers, Oakland. Director (5 years), A. M. Rawn, Los Angeles County San. Distr., Los Angeles. Director (2 years), J. I. Ballard, Eng. News-Record, San Fran-

* Ass't Chief Engineer, Los Angeles County Sanitation Districts and Retiring President of the Association.



The New Terminal Island Treatment Works of Los Angeles, Calif.

cisco. Member Board of Control, C. G. Gillespie, Chief Engr., State Dep't Health, Berkeley.

A Digest of Papers Presented

The New Terminal Island Treatment Plant and Proposed Improvements to Los Angeles' North Outfall and Treatment Works, by C. G. SMITH, Engineer of Sewers, Los Angeles.

Sewage from the city of Los Angeles and a number of its smaller neighbors, is collected through some 3,000 miles of laterals and interceptors and conveyed 20 miles through the North Outfall Sewer to the disposal works at Hyperion on Santa Monica Bay. The present installation at Hyperion comprises ten 12-foot diameter 40 c.f.s. capacity, revolving drum-type Dorr screens with 1/16-inch slot openings. Plant effluent is disposed of 5,000 feet from shore through an 8-foot concrete outfall terminating at a 60-ft. depth. Floatables of the settleable suspended solids are removed from an average daily flow of 130 c.f.s. at this plant, the 30 tons of wet solids retained at the plant being pressed to release free-water and then burned in a Morse-Boulger incinerator.

The city of Los Angeles owns 220 acres of shore lands upon which the plant is situated and, following a seven million dollar WPA appropriation in 1935, has commenced construction upon a new plant involving plain subsidence and separate sludge digestion. Included in the new work is the removal of some four million cubic yards of beach sand-dunes and approximately 15,000 tons of sewage screenings buried a number of years ago.

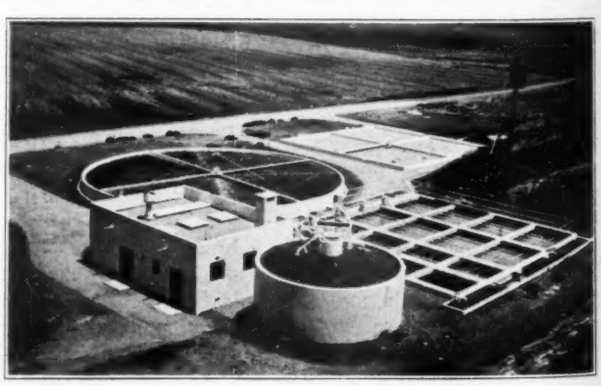
In the new plant fine screening will no longer be practiced and the present screen house will accommodate the sludge conditioning, dewatering and drying equipment. Incoming sewage will pass an automatically cleaned bar screen, thence through one of two detritors and into three skimming tanks in parallel, each 45 x 90 feet in plan and 12 feet deep. Prior to entering the skimming tanks the sewage will be aerated for a short period by jetting small streams of water at high velocity at the surface of the sewage. From the grease skimming tanks sewage will flow to six 200-foot diameter, center-feed clarifiers, each having 16 feet center and 6 feet side wall depths. The clarifiers are designed for 825 gallons per square foot per day over-flow rate at average flow. Tanks are to be so constructed that they can be expanded radially if desired and adapted to the Laughlin process of sewage filtration.

Two-stage sludge digestion will be employed in six 110-foot diameter tanks, each 34 feet in depth. Conditioned with ferric chloride, the sludge will be filtered and kiln dried in 15 per cent moisture. Sludge gas will be used for power generation, incineration of grease and sludge drying; and supernatant liquor from the digesters will be returned to the incoming raw or to the effluent as conditions dictate. It is proposed to install four 250-H.P. sludge gas engines direct connected to generators. Sludge drying equipment must provide for the evaporation of 8,000 lbs. of water per hour. The plant is being designed for 130 m.g.d. average flow and will be equipped with a by-pass for storm flows.

On Terminal Island, in the Los Angeles harbor area near Wilmington, the city has constructed a $175,000 separate sludge digestion plant of 10 million gallons capacity to which is now conveyed sewage from the harbor area. The new plant went into operation Sept. 1, 1936.

The present average flow is only about 3.5 m.g.d., although there are four pumping plants pumping sewage to the Terminal Island works and when these chance to go into operation simultaneously the rate may exceed 12 m.g.d. for short intervals. The sewage is combined domestic and strong industrial waste, solids running normally about 275 p.p.m. but occasionally during each working day fish cannery wastes averaging 2,200 p.p.m. solids and 10,000 p.p.m. of oil are discharged into the plant.

Raw sewage flows directly to a center-feed clarifier 85 feet in diameter and 13 to 16 feet in depth. The clarifier is equipped with a grease skimmer—the grease



New Plant Involving Bio-Filtration (Filter, 85 ft. Diam., Only 3 ft. Deep), Camarillo State Hospital

Snapped on the Inspection Trip

Alva M. Smith, Cons. Engr., and A. E. Lee, Tunnel Engr.; A. K. Warren, Chief Engr., Los Angeles Sanitation Dist., Introduces Floyd Shaefner to C. C. Kennedy (Right), Cons. Engr. of San Francisco

flowing to a concentration tank preparatory to incineration. Supernatant liquor from the clarifier is discharged 1,000 feet seaward into the harbor through a 30-inch diameter cast iron pipe outfall. The digester (single-stage) is 75 feet in diameter and 27 feet deep, and has a fixed concrete cover. However, connected with the digester are three decantation tanks (16 ft. diam. x 30 ft. depth) which will serve as secondary storage and maintain constant sludge level in the digestion tank. Sludge gas is to be used for power generation and the incineration of grease.

Improvements in Sewage Treatment and Disposal for Stockton, California, by CLYDE C. KENNEDY, Consulting Engineer, San Francisco.

Mr. Kennedy stated at the outset that his paper was to be considered, in a measure, as a sequel to an earlier contribution by W. T. Ingram, which dealt with the relation of industrial wastes to the total sewage load at Stockton, and published in Vol. VIII, No. 1 of the California Sewage Works Assn. Journal.

Sewage from Stockton, after meager preliminary treatment, has been emptied into the tidal estuary constituting the port of Stockton. Investigating the diluting and oxidizing capacity of the estuary, Mr. Kennedy concluded that, during the critical summer months, fresh water from the San Joaquin River, which empties into the estuary, plus oxygen due to surface absorption and aquatic life, would probably amount to 29,000 lbs. per day available for reduction of the organic solids and sewage. Due to the fact that the change in waters in Stockton harbor during the summer is almost entirely due to the up-and-down movement in the tidal prism, Mr. Kennedy limited the available oxygen to be supplied to an area of 750 acres of the harbor, plus the small amount added from the flow of the San Joaquin.

The measured flow of sewage in the city system and a study of its characteristics indicated that the solids contained therein would exert a 5-day B.O.D. of 14,300 lbs. per day for normal flow and 51,500 lbs. per day during the canning season. Future expansion in industry and population disclosed that the raw sewage might be expected to exercise an excess oxygen demand of 35,300 lbs. per day during the critical canning season and that, therefore, treatment must be provided to reduce the organic oxygen demanding load by 55 per cent.

Upon this data the two totally inadequate plants at Stockton are to be revamped to include detritus tanks, fine screens and susidence prior to disposal by dilution. The subsidence tanks are designed upon the basis of 1000 gallons per square foot per day overflow rate for the critical annual season. Laboratory experiments indicate that such treatment will produce the required results.

Sludge from the North plant is to be pumped 10,000 feet to the South plant and, together with sludge from the South plant, given preliminary digestion in remodeled Imhoff tanks. Thence it will flow to digestion lagoons, suitably isolated, for final digestion and subsequent disposal. Mr. Kennedy said that work had commenced upon the improvements, which are estimated to cost $137,000, and the plant would probably be available for use during the canning season of 1937.

Shifting the Trickling Filter Into "High," by H. N. JENKS, Berkeley, California.

Mr. Jenks directed attention to the sturdy qualities of the trickling filter, popular in sewage treatment for the past forty years. Commented that since the advent of the trickling filter, speeding up of sewage treatment had been confined to other processes—such as, chemical precipitation, activated sludge, mechanical filtration, etc. Said that the Jenks process of bio-filtration, while continuing to utilize the natural assets of trickling filter and its general principles, had increased capacity—efficiency many times.

The Jenks Bio-Filtration Process incorporates the practical return of filter bed discharge to incoming sewage in amounts (two to five times the sewage flow) found requisite for the degree of treatment sought and contingent on the sewage or waste characteristics. However, the rate of dosing could thereby be materially increased, the economic rates of application of sewage-filtrate mixture for a bed 3 feet in depth being 18 to 24 m.g.d. per acre of bed.

Mr. Jenks then discussed conditions of "free-flow" through filter medium, stating that clogging in a biologic filter is as much the result of anerobic conditions as the cause of such. Then, since it had been found that backwashing had not at all adversely affected biological efficiency in a sprinkling filter, it followed, similarly, that high rates of filtration, particularly with the mixed filtrate and incoming sewage, may be expected to maintain the filter medium in a healthy free-flowing condition. He described a free-flowing filter as one wherein the rate of passage of liquid through the bed is intermediate between flushing and flooding of the filtering material. Discussing the significance of recirculation, Mr. Jenks said, in part: "The beds should be activated

through the return of portions of the effluent" and "The environment within the bio-filter bed is at all times conducive to an active condition of a relatively small volume of biologic jelly and hence, in a practical way, fulfills the theoretical requirements for rapid bio-chemical oxidation."

Mr. Jenks concluded with a summary of plant design, range of treatment and summary of engineering factors, such as:

1. Economic depths of bio-filter beds are between two and four feet, with corresponding ranges of filtration of from 18 to 24 m.g.d. per acre.
2. For complete treatment the aggregate detention period should be from 4 to 6 hours with the latter for strong domestic sewage.
3. Up to a recirculation ratio of 6 volumes of filtrate to one of raw sewage, the removal of oxygen demanding constituents, per cubic yard of filter media, varies directly with the ratio of recirculation rate to crude sewage flow.

Proposed Improvements in Sewerage Facilities at San Diego, by B. D. PHELPS, Assistant City Engineer, San Diego.

Mr. Phelps stated that San Diego has nine raw sewage outlets into San Diego Bay, twelve into the open ocean and one into Mission Bay; that in spite of the need for modern sewerage facilities, the city is unable at this time to provide adequate funds for the improvement. Fortunately the existing lines lend themselves nicely to an alongshore trunk sewer leading to a tract of city-owned property, well isolated from the residential area, and upon which it is proposed to construct a treatment plant as soon as it can be afforded.

San Diego has a population of approximately 170,000 and caters to throngs of visitors the year round. The ocean shore waters are extensively used for recreational purposes and civic officials are entirely conscious of the need for better sanitation. The PWA has been requested for a loan and grant of $2,000,000 and in expectation of its receipt, tentative sewerage plans have been made. They include possible water reclamation for agricultural purposes, sludge and gas reclamation and use; but, primarily, adequate protection to recreational shore waters. Preliminary estimates indicate that of the $2,000,000—25 per cent will be expended for the treatment plant, 50 per cent for trunk sewers and the remainder for pumping stations and other incidental and miscellaneous costs.

Certification of and Schools for Sewage Plant Operators—A committee report by R. F. GOUDEY, Chairman.

The recommendations contained in this report substantially were: that operators be grouped into three classes according to experience and education and certified accordingly by a committee of three members from the Sewage Works Association; that certification be voluntary and terminate at the expiration of five years unless renewed; and finally that, subsequent to April, 1937, certification will only be made upon proper showing and written examination, but that prior to that date certificates of classification could be issued upon application and a showing of experience and education.

Reporting upon schools for operators, Mr. Goudey discussed at length the methods and means which might be employed in the establishment of such a school, outlined the curriculum and finally recommended that the Association appropriate money for the establishment of a one-week school during the summer of 1937, to be held in conjunction with the School of Public Administration at the University of Southern California, as a nucleus around which to build a more extended course as soon as possible.

The Association accepted and adopted all of these recommendations.

Report on Regulations to Insure Safety in the Maintenance, Operation and Reconstruction of Sewers—A committee report by F. A. BATTY, Chairman.

Culminating an eight-year discussion on this subject at association meetings, Mr. Batty presented a brief, concise set of rules and precautions aimed at the protection of the lives and health of men who work in and about sewers. The regulations are all practical to the extent that they are in general use and will serve to call the attention of the uninitiated to the hazards involved and protective measures to be taken. The report is to be printed in manual form and distributed to association members, to cities and other interested agencies throughout the State.

Legislative Committee Active—W. T. KNOWLTON of Los Angeles reported for the Legislative Committee and stated that this committee was making a careful study of pending legislation—both State and National. He asked that authority be granted the Board of Directors of the California Sewage Works Association to act for the Association upon recommendations regarding the application of pending legislation. Mr. Knowlton's recommendation was accepted and adopted.

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WOULD CO-ORDINATE NEW JERSEY WATER SUPPLIES.—The North Jersey District Water Supply Commissoin has concurred in the action of the State Water Policy Commission in seeking a WPA survey of public water supply systems in the metropolitan area for the inter-connection of adjacent systems.

Snapped on the Inspection Trip

From Left: A. W. Wyman and Bill Allen, Supt. and Asst. Supt. of Pasadena's Treatment Works; Adolph Koebig, Cons. Engr. and R. E. Goudey, San. Engr., Los Angeles; Fred West, Supt. of Sewage, and W. T. Ingram of Stockton

TENTH ANNUAL OHIO CONFERENCE ON SEWERAGE

THE 10th Annual Ohio Conference on Sewerage and Sewage Treatment was held at Columbus, Ohio, October 1st and 2nd, on the heels of the 16th Annual Ohio Conference on Water Purification established and fostered by the State Department of Health and said to be the first Conference of its kind organized in America.

The opening session was addressed by Myron B. Gessaman, mayor of Columbus, who told of the excellent progress being made in sewerage betterments at Columbus and the status of the new treatment works being constructed under Robert A. Allton's supervision as Columbus' capable Sewerage Engineer.

At the Annual Dinner, C. D. McGuire, as toastmaster, introduced Ohio's Commissioner of Health, Dr. W. H. Hartung, who made brief, appropriate remarks. Then followed the principal speaker, H. L. Sain, Engineer of Ohio's Industrial Commission, who spoke entertainingly and interestingly on "Safety First and Accident Prevention."

Gadget Contest and Business Meeting

Repeating its display of "gadgets" by contesting "gadgeteers," Conference members voted the following prizes:

1st —to C. D. McGuire (Columbus), for laboratory and sampling-bottle stopper holders.

2nd—to Hubert Kline (Dayton), for dissolved oxygen sampler.

3rd—to Albert H. Fretter (Medina), for punched gage or flow charts, providing metal contact and alarm sounding when the recording pen reaches the punch hole located at any desired point on chart—low water, high water, etc.

In the Business Session, F. D. Stewart reported that $449, contributed by manufacturers and others, had made it possible to print proceedings skipped during two depression years and that these would be distributed to members, and sold at $1.00 per issue to non-members.

Officers announced for the ensuing year were:

Chairman—G. Albro Hall, Sup't, Treatment Works, Norwalk.

Vice Chairman—M. W. Tatlock, Sup't, Treatment Works, Dayton.

Treasurer—J. W. Wenger, Sup't, Treatment Works, Westerville.

Secretary—Bruce M. McDill, State Dep't Health, Columbus.

To the Executive Committee, composed of the above officers, J. J. Wirtz was added as the member at large.

Albert Fretter, Supt., Water & Sewage, Medina, Retiring Chairman

G. Albro Hall, Supt., Sewage Treatment, Norwalk, Ohio, New Chairman

Camera Play (1/10 Sec., 2.7 Lens): Two shots looking up from Columbus Plant's Interesting Valve, Meter and Pipe Gallery. Note the Air Trap Syphon to Preclude Back Flooding

Columbus Plant Inspected

On the second day Conference members adjourned from the Breakfast Round Table Session (New York Sewage Works Assn. started the idea—Ohio tried and likes it) to visit the 50 M.G. Activated Sludge Plant now under construction, where many of the novel features of design and projected operation were pointed out and explained by Robert Allton, Sewerage Engineer, in charge of design and construction, and C. D. McGuire, Chemist, in charge of sewage treatment. (Too many to recount here, features of the Columbus plant, involving novel design and arrangement of equipment, will be the subject of an article by Mr. Allton, scheduled for a forthcoming issue. This, we think readers will find, is to prove one of the most interesting and valuable articles scheduled.—Ed.)

Technical Sessions

(Chairman Albert H. Fretter, Presiding)

"Comparing Sewages on the Basis of Oxygen Demand per Capita per Day," by Bruce M. McDill, Ass't Engr., State Department of Health, Columbus, Ohio.

Mr. McDill, with the aid of tabulated data gathered

Bruce McDill, Secretary, Ohio Dept. of Health

Daniel "Sunflower" Rupp. A Charter Member from Far-off Topeka, Kan. — Returns Each Year

at a number of Ohio's treatment plants, presented a very vivid and interesting picture of the value of figures disclosing variations in the factor Lbs. of B.O.D./-Capita/Day, as compared to observed B.O.D. and flow figures. He pointed out that this was, after all, the true index of plant loadings; meant more than the strength of sewage. It was the most certain index of the extent to which industrial wastes become an increased load. This, because the O.D./Capita/Day varied but little with sewage concentration changes (water consumption per capita as illustrated by the charted data) as long as domestic sewage constituted the only or principal loading. For example, Delaware, Ohio, with a per capita water consumption of but 46/gal./day and a sewage averaging 368 p.p.m. 5 day B.O.D., showed an O.D./Capita/Day figure of only 0.142 and compared with Dayton and others with much more dilute domestic sewages. On the other hand, Cleveland with normally a dilute sewage showed the effects of industrial waste loadings; to wit, the figure of 0.221. And Medina, likewise, at a O.D./Day/Capita figure as high as 0.233, and Norwalk when at a 0.256, showed the effects of seasonal pickle and canning plant wastes.

Mr. McDill said that the O.D./Capita/Day figure of 0.142 could be considered characteristic for the average domestic sewage of Ohio cities. An example of seasonal trade waste loading was cited at Norwalk where the figure in July was 0.122, rose to 0.256 in August; 0.210 in September, and returned to 0.126 in October. At Cleveland the figure of 0.221 indicates extent of waste loading.

The fact was again stressed that the B.O.D./Capita/-Day figure was that which had the major significance in design and loadings of units and streams. Also, in computing plant efficiencies, it was the most useful and dependable factor and should be recorded. While hydraulic design hinged upon volume flow, loading design should be hinged on peaks in oxygen demand.

Question: Did the high rates for water which resulted in the low water consumption of 53 gals. per capita at Medina have anything to do with the figure of 0.233 lbs. O.D./capita shown. Not at all, was the reply: That figure revealed what happened when 33 per cent of the sewage flow represented waste from a pickle factory. Note that Delaware, with 46 gal./capita and no industrial waste, had no such figure.

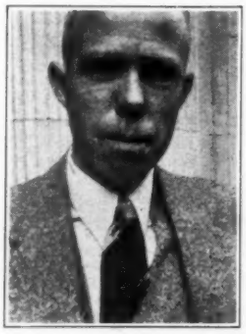
"Trickling Filter Loadings," by G. ALBRO HALL, Sup't, Treatment Works, Norwalk, Ohio.

In a highly complimented paper, Mr. Hall presented and discussed operating data applied by himself in a study of the effect of trickling filter loadings at 8 typical Ohio plants handling a wide variation in loadings. In keeping with predictions reached in a previous paper, presented by B. F. Hatch before the 5th Annual Conference, the highest efficiencies had resulted from filters handling not more than 5.7 lbs. of 5 day B.O.D. per day, for each 1000 cu. ft. of stone in the beds. He had observed that filter effluents having not more than 40 p.p.m. B.O.D. seemed to remain stable. No opportunity, to date, had been had to test the upper limit of allowable sewage strength, the 400 p.p.m. B.O.D. limit set by Mr. Hatch. However, as an example of what a filter would stand for short periods, he cited Norwalk experiences, in which late Summer loadings in the nature of corn canning wastes had been successfully handled at rates shown to be 15 lbs. of B.O.D. per 1000 cu. ft. of stone. From loadings of 12 lbs. effluents with 30 p.p.m. B.O.D. had been produced for a time. On the other hand, in early Spring a milk plant waste, raising the loading to only 9 lbs., had resulted in a poor filter efficiency and 70 B.O.D. effluent.

Conclusions reached: 250 lbs. 5 day B.O.D. per acre/foot [5.7 lbs./1000 cu. ft.] was with certainty safe practice. It was evident, however, that periodic loadings could considerably exceed the safe average—certainly in the warmer seasons. At Norwalk, 5 times the limits (5.7 lb. limit) recommended had been handled for several days, but the performance gradually went down hill with such high loadings continued.

Mr. Hall pointed out that modifications such as forced draft, recirculation and better distribution might offer a new light on tolerance loadings on these remarkable units for sewage oxidation.

B. F. HATCH, Assistant Engineer of the Ohio Department of Health, by way of discussion, presented a series of study graphs being prepared in order to study performance and tolerance of typical Ohio trickling filters to loadings (constant and variable), filter depth, stone sizes, distribution, etc. He stressed the fact that efficiencies were interesting but the crucial test in reaching conclusions was the residue of B.O.D. in the effluent. Aside from strength and volume, a third important factor to consider was the *oxidibility* of the organic loading, when industrial wastes were a factor. He pointed out that the Delaware filters stood the highest domestic loading of any in Ohio, gave an efficiency of 86 per cent (highest in Ohio) but a less consistently high grade effluent than the Akron filters which showed a lower efficiency in percentage removals. The notoriously overloaded Columbus filters had a remarkably high percentage efficiency but a very inferior effluent. Taken as a roughing unit, however, its record was remarkably good. Pointing to industrial waste effects, Cleveland's filters had an efficiency of only 74 per cent,



E. F. Eldridge, Chemist, Michigan State College; Doing Nice Work on Beet-Sugar Waste Treatment.

"A. B. C." Cameron, Supt., Springfield, Ill. Presented a Paper on Sludge Dewatering of Prize Winning Calibre.

On the Columbus Plant

C. D. McGuire, Supt. of Treatment—Will operate it; Robt. A. Allton, Sewerage Engr.—Designed and building it; Robt. T. Regester, Chief Designing Engr.—Did his share

which dropped to 63 and later returned to 72. (Mr. Flower of Cleveland explained this situation as due to a period of poor plant management, with molasses wastes sharing the blame.)

M. W. TATLOCK, Sup't, Treatment Works, Dayton, Ohio, in reply to a request, discussed the findings from the Dayton experimental filter, operated preparatory to operation of the large rotary distributor 6 ft. deep filters under construction at his plant. In the upper first foot of stone the B.O.D. removed had been 50 per cent (50 p.p.m. roughly) and progressed through the next 5 feet at the constant rate of approximately 8 p.p.m. per foot, leaving a residue of 7 to 10 parts. Dissolved oxygen pick-up was observed in the upper 3 feet, reaching 5.4 p.p.m. maximum and thereafter decreasing somewhat with depth. Oxidized nitrogen (nitrate and nitrite) had increased through the whole depth, starting one foot below surface with a consequent parallel line of ammonia decrease with depth.

(With the remarkable opportunity to further study sprinkling filter design, performances, tolerance loadings and methods of improving loadings tolerances in Ohio, the Conference voted that a Committee on Trickling Filters be established for the purpose of continuing the valuable contributions from Messrs. Hatch and Hall to date. See also the reflections later from the Topical Group Discussion on Trickling Filters.—Ed.)

"The Soundness Test for Filter Media," by R. D. SCOTT, Chief Chemist, Ohio Department of Health, Columbus, O.

Mr. Scott reviewed the recommended test procedure of the A.S.C.E. involving the 18 hour sodium-sulphate soak, drying and repeating the cycle 20 times. Also, methods of evaluating failure due to splitting and spalling. He outlined recommended modifications to shorten and improve the procedure, as based on 9 years' experience with the test. He considered the test drastic and only two materials had consistently stood up under it—slag and gravel.

R. R. LITEHISER, State Highway Department, concurred with Mr. Scott's recommendations, condemned the A. S. C. E. and the very similar A.S.T.M. standard procedures; said that while serving as guides neither had been fair to materials known to stand up by their actual service records. Highway laboratories had been turning to actual freezing and thawing tests as more natural and reliable.

H. F. KRIEGE, Research Engineer (connected with allied stone interests), also condemned the sulphate test as being too drastic; noted its failure to check in different laboratories on identical materials. Length of immersion was considered excessive (5 min. being ample) and needlessly delayed acceptances 20 days. In every respect an aggregate material such as igneous trap rock, granite, etc., was safer against weathering than the sedimentary limestones, sand-stones, etc. In filters the thought of a top layer of absolutely safe material above a speculative material would prove economical and sound.

Some one stated later in the meeting that examinations had shown a frost penetration of not more than 10 inches—6 inches in most instances—of sprinkling filters even at 24 degrees below zero when ice mounds were above the stone.

In reply to a question by L. H. Enslow, the discussor preferred not to give an opinion as to the probable reliability of anthracite—a sedimentary material. To this, Mr. Scott replied that a sample of "Anthrafilt" had stood up under the sulphite test in good order.

Breakfast Round Table Reports

At the "Breakfast Round Table," members presiding over the 4 individual group meetings for Topical Discussion the previous afternoon, presented a digest of the discussions taking place.

"Primary Sedimentation and Sludge Digestion." (In charge, ROBERT A. ALLTON.) Of the considerable discussion the following highlights were taken: (a) For metering sludge gas, the bellows type meter seemed superior to other types. (b) Bronze bolts had been unsatisfactory in sludge and some sewages. Cadmium plated bolts were being used instead. (c) In corrosion tests in gas vents of Imhoff tanks (H_2S, methane, etc.) Cast-iron had stood the test effectively. (d) Aluminum piping in sludge digesters had proved unsatisfactory due to alkali, sulphide and ammonia attack.

"Trickling Filters and Sand Beds." (In charge, M. W. TATLOCK.) (a) Frost penetration of filters had been only 6 inches below surface, even at temperatures of 24 below zero for a period. (b) Waste from Medina's pickle plant had cleaned out the filters, including worms and Psychoda fly larvae. (c) Apparently only about 25 per cent of the solids going into trickling filters could be recovered in the form of humus tank sludge. The best method of disposing of humus sludge (0.3 per cent solids) had yet to be discovered—it caused trouble in digesters and was difficult and frequently odorous on sand beds. At Dayton about 45 per cent of the solids going to filters could be accounted for—30 per cent in the humus sludge plus 15 per cent in the final effluent. At Norwalk apparently 30 per cent of the solids were converted to soluble matter or otherwise wet burned in the filters. One member pointed out that filters accumulated and then disgorged intermittently. It would be impossible, therefore, to account for organic solids by any practical sampling or sludge measuring scheme. (d) From the discussion of ventilation value, no decision could be reached; but, temperature

Consultants All

A. A. Burger of George Gascoigne Engrs., Cleveland; R. F. MacDowell of R. F. MacDowell, Cleveland; Floyd G. Brown, Operating Supervisor and Consultant, Marion

"Activated Sludgers"

E. E. Smith, Supt., Water and Sewage Works, Lima, Ohio; Jim R. Collier, Supt., Treatment Works, Elyria, Ohio; C. K. Calvert, Supt. Treatment Works, Indianapolis, Ind. (Pioneering Operator in Activated Sludge)

control thereby seemed more promising—possibly by glass covers for Winter warmth and for discouraging fly breeding in Summer.

"Activated Sludge Treatment." (In charge, E. E. SMITH.) (a) Methods of disposal of excess sludge were all but satisfactory. Added to the crude sewage; much of it passed the primary tanks back to the aerating units and in such condition as to cause serious oxygen depletion and troubles. Added to the digesters: too serious dilution, too disturbing to supernatant liquor separation, too temperature reducing, created "elutriation" and the serious problem of high volume supernatant. Best solution was a thickening operation of some sort and delivery therefrom to digesters direct. Concentrating tanks (deep and narrow) aided by chlorine to check fermentation seemed the best proven method. Trials under way with thickening centrifuges (8 to 10 per cent solids in a continuous discharge) held great promise. The watery effluent from machine was returnable to aeration tanks direct, possibly to final effluent. There would be a limit to the solids content in centrifugal sludge to the digesters. This for economy of operation and best functioning of centrifuge and digesters. Demonstrations were now under way at Lima, O., and elsewhere.

(b) Stage aeration seemed both logical and basically the scientific attack to render the activated sludge process mort efficient and economical, and controllable. Over capacity of air was much needed in the critical first stage to take care of intermittent overloading with organic input, stale sewage, and to take care of heavy return of sludge when required.

(c) The "Odeometer" seemed to have possibilities—the most valuable Odeometer was, however, the plant itself. The aeration tanks, the contact chamber and a study of dissolved oxygen in catch samples of aeration tank contents from inlet to outlet end revealed the requirements. Reference was made to the Rockville Center, N. Y., plant (see WATER WORKS AND SEWERAGE for September, 1936, p. 344) in which control of solids carried in aerators (return sludge ratio) had been worked out on the basis of dissolved oxygen maintained at various points through the aeration units, resulting also in a form of stage aeration to meet requirements, and the limiting of sludge return to meet air capacity limitations. From such studies a routine program could be developed for meeting day to day or seasonal requirements; better than that of any other suggested scheme.

(d) Where air capacity allowed such, carrying as much as 4000 p.p.m. suspended solids in the system served to take the shocks of sudden loading—peaks or industrial wastes reaching the plant. The method was expensive and subject to limitation of air capacity.

(e) Supernatant liquor had better be returned gradually to the aeration units direct than to the crude sewage. Disposal was simplified greatly by stage digestion or else by concentrating excess sludge going to the digesters. With the aid of chemicals, supernatant could be dewatered on sand beds. Run to lagoons, where available, it was non-offensive and gradually seeped away or evaporated.

(f) Long primary sedimentation appeared more deleterious than helpful to activated sludge. Detritus tanks of 20 to 30 minute detention, removing the heaviest material and grease and the like, seemed sufficient and probably more advantageous overall than efficient settling units. For ordinary sewages there was a lack of evidence that efficient primary sedimentation had created economy in air consumption when compared with plants without it.

(1) *Dorrco's Nelson;* (2) *A. E. Hess, Supt., Alliance;* (3) *C. T. Kaiser, Supt., Newark;* (4) *E. C. Sargeant, Supt., Lakewood;* (5) *Paul Kleiser, Indiana Dept. Health;* (6) *Diffusing, Frank Aloxite Roe*

Industrial Waste Treatment

"Beet Sugar Waste Treatment," by E. F. ELDRIDGE,

"Sprinkling Filterers"

George Flower, Supt. Treatment Works, Cleveland. (Has long operated them.) "Bernie" Hatch, State Dept. Health, Columbus. (Has Lots of "Know" Concerning Them.) M. W. Tatlock, Supt. Treatment Works, Dayton. (Is Building Several of Them.)

Research Chemist, Michigan State College, East Lansing, Mich.

Mr. Eldridge, after briefly recounting the process of beet sugar manufacture and the sources, amounts and relative importance of the various wastes, reviewed progress with experimentation, looking toward treatment by the most practical and economical means in a pilot plant of 100,000 g.d.p. capacity. Conclusions reached were that the flume-water should be treated for grit removal (800 cu. ft./m.g.) and 1.5 to 2 hrs.' sedimentation, in mechanically cleaned tanks, to secure 50 per cent B.O.D. reduction. Process water to be treated with 600 p.p.m. burnt lime, mixed and flocculated 15 min., settled 2 hrs. Experiments had shown that mechanical vacuum-filtration at the rate of 100 gal./sq. ft./min. was possible. The allowable application at the rate of 1 m.g./acre/day to a sprinkling filter was considered too costly. The highly organic Steffen's waste (54,000 B.O.D.) could be mixed with flume or process water to the extent of 4 per cent in the above treatment. However, a process involving by-product recovery from this waste seemed sounder.

Two large scale projects (1 m.g.d.) were ready for storage tanks at the plant, or plants, which might be emptied gradually each night between the hours of retiring and rising time of the community, when domestic sewage flow is at a minimum in volume and strength. The municipality would construct and operate the required works at its plant site to effectually treat the industrial sewage and pro-rate the operating costs to the manufacturers served. In this manner all wastes would be centrally treated under municipal supervision and to that degree required. Possibly this would be to the extent of putting the chemically treated effluent through the biological plant units, in part if not in whole, during those hours when the latter would otherwise be "loafing." The scheme had the appeal of being, over all, the most economical where several polluters were involved, otherwise entailing as many individual and questionably operated plants if done by the manufacturers. It seemed proper that the sewer and industrial part of the treatment plant be financed from tax funds; but its operation be on the assessment basis according to the industrial loading discharged to the sewer. The scheme had its appeal to manufacturers faced with the possibility of having to build and operate individual

(1) *W & T's Trickster, "Bud" Fischer;* (2) *Jeffrey's Bradshaw;* (3) *Lakewood's City Engr., E. A. Fischer;* (4) *A. Duer, Supt. of Treatment, Orville;* (5) *H. C. Crowdon, Chemist in Chg., Portsmouth;* (6) *S. I. Zack, Filtration Equipment Corp.;* (7) *Chicago Pump's Chemical Engr., Milton Spiegel*

trial in the coming season at Bay City, Michigan—one patterned on the pilot plant and the other involved spray-drying of the heavy Steffen's House waste containing 4 per cent solids, much potash and nitrogen. Sufficient waste flue heat was already available to spray dry 60 per cent of this waste.

JOHN W. PFEIFER, General Manager, Ohio Sugar Company, explained some of the economical and technical problems confronting the industry in planning its waste treatment. Water re-use in part held some promise and might reduce the waste by 25 per cent. The heaviest wastes would be difficult if not impossible to re-use, and for such re-use or disposal chemical precipitation alone did not seem sufficient. In the evaporation scheme there was hope.

B. F. HATCH, Ass't Engr., Ohio Department of Health, pointed out the fact that, by survey, industrial pollution in Ohio was equal to or exceeded domestic pollution in population equivalent—one average beet sugar plant being equivalent to a city of 280,000 people in stream loading. The three methods of correction considered singly or as a combination were: (a) process changes in the plant; (b) water re-use, i.e., partially closed system; (c) treatment of all or the residue of the waste. Industrial waste treatment now offered a great field for sanitary engineers prepared to handle the work.

L. H. ENSLOW, commented on situations wherein industrial wastes were up-settling municipal treatment works; something more common than not. It seemed that a likely solution in such cases lay in the use of waste treatment plants. It should have an appeal to municipalities wishing to assist home industry.

C. K. CALVERT, Sup't, Treatment Works, Indianapolis, Ind., foresaw a sad state for the biological works of a municipality under any such scheme which tended toward making industrial sewers of domestic systems.

MR. HATCH said that Mr. Enslow's scheme possessed practicabilities and stated that a very similar scheme was to be tried in Ohio, wherein the industrial plant was recovering as much as practicable and sending the residue to the municipal plant for treatment.

"Sewage Treatment to Handle Industrial Loadings at Orville, Ohio," by CHAS. C. HOMMON, Consulting Engineer, and Superintendent of Treatment Works, Canton, Ohio.

Mr. Hommon told of the Orville development which is a very near approach to the scheme of waste treatment by the municipality, as outlined in Mr. Enslow's proposal. Here was a case of a seasonably over-taxed biological plant which has continued to take the wastes from three milk products plants under agreement that the manufacturers pay the pro-rated cost of preliminary chemical precipitation of the waste plus domestic sewage reaching the plant. The scheme had proved successful and the manufacturers are billed monthly on the basis of the contributed population-equivalent of each waste, determined by total estimated pounds of oxygen demand per day from each plant. The manufacturers were satisfied with the arrangement, as were the municipal authorities.

Mr. Hommon explained that chemical precipitation

had been arranged for but not used until filter ponding indicated its necessity. Ferrous sulphate and lime were not successful, whereas, anhydrous ferric-chloride had proved successful, even with only crude flash mixing and no flocculating device. The coagulant had been added only between the hours of 7:30 a. m. and 11:00 p. m. with but crude control, and a rate averaging 3.3 gr./gal. By this scheme suspended solids removals by the settling tanks had been raised to 80 per cent (419 reduced to 84); and, B.O.D. reduction from 745 to 325—with 10 p.p.m. remaining in the sand filter effluent at rates of 115,000 gal./acre/day and no ponding. Total cost of sewage treatment at Orville (pop., 4,400) had been $1.14 per capita/year. Of this amount the industrial plants had paid $2,593 and approximately $6,000 had been paid in as sewer rental by property owners—a happy profitable solution of the problem and a real service to industry.

A. E. KIMBERLY, State PWA Engineer, Columbus, Ohio, pointed out that the Orville industrial load had been more than twice the domestic load. During his connection with the problem he had studied chemical precipitation at the individual creameries but considered the new scheme preferable to individual plants. Orville's experience had shown the value of chemical treatment ahead of biological units in combatting industrial waste, as seasonal loading problems. He believed that many situations exist which could be bettered by the same scheme.

Replying to a question, Mr. Kimberly explained that the industrial load in population-equivalent was determined by taking industrial flow and oxygen demand measurements, calculating the total pounds of oxygen demand, and dividing by the average domestic sewage figure of 0.16 lbs./capita/day or whatever other figure might be obtained from the domestic loading on the particular plant.

Sludge Filtration

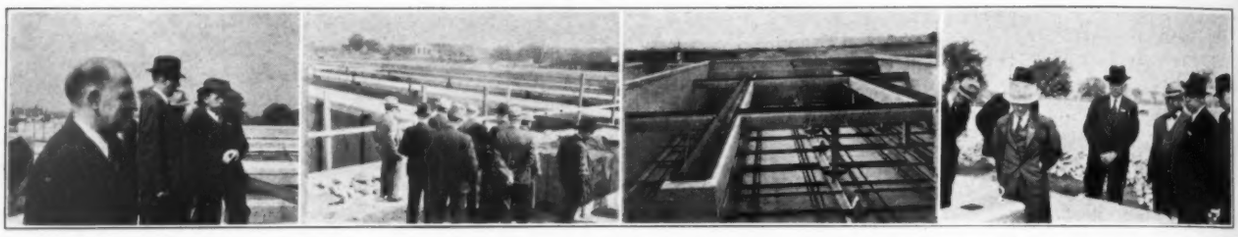
"Experiences With Mechanical Filtration of Sludge at Springfield, Ohio," by A. B. CAMERON, Sup't, Treatment Works, Springfield, Ohio.

Mr. Cameron's well-constructed paper constitutes a valuable contribution to the art of mechanical sludge dewatering. Believed to be the only plant operating a vacuum filter on digested sludge to date, Mr. Cameron's findings should be very helpful to those with projected installations or considering such.

The contemplated use of ferric chloride, as the single conditioner, had proved too costly and lime application following the iron salt to secure alkaline filtration, was resorted to. Rates of filtration mounting to between 12 and 14 lbs. of dry solids (cake) per sq. ft. per hour had resulted, and chemical costs had been reduced to $2.25 per dry ton and subject to a further reduction of 50 per cent by replacing hydrated lime with pebble lime. Chemical dosage rates involved 1.94 to 2.01 per cent ferric chloride and 9.1 to 14.5 per cent hydrated lime. The greater economy had been found by adding the iron salt first (at a fixed rate) and thereafter the lime at variable rates to meet conditions. With a total alkalinity of roughly 2,600 p.p.m. the filtrate was clear and the cake had averaged 60 per cent moisture. Experience had shown that rapid drum travel and thin cake had given the highest output per filter and that the operator's eye and experience were the most practical control measures in altering the lime dosage, sludge density, etc. Woolen filter cloth had been discarded in favor of cotton Canton-flannel which turned out 200 tons of cake (dry basis) between changes. Next, an 8 oz. cotton duck, good for 140 tons between changes, was the choice. Cloth change required a 4 hour shut-down. To operate the filter one control man and two others to handle the cake had been required.

The "Ferro-Feeder" had been completely satisfactory but the automatic features of control between sludge flow and chemical feeding had been discontinued in favor of manual control. Lack of sludge gas-holder had complicated sludge withdrawal operations and proved a handicap to more efficient operation of the sludge dewatering process, the digesters and the gas utilization equipment. In a study of relationship between sludge density, filtration rates and chemical costs it had been found that a dense sludge proved more economical to dewater. Between 14 and 17 per cent solids (optimum for Springfield sludge) the maximum overall economy resulted. From such a yield of 14 to 18 lbs. of solids per sq. ft. per hour could be expected. The more completely digested the sludge, the higher the filter capacity. It was Mr. Cameron's belief that stage digestion or ample sludge storage tanks would prove helpful in this attainment.

At the Columbus, Plant



(1) *Tatlock, Calvert, Allton (Master of Ceremonies);* (2) *Looking Across the Aeration Tanks (Too Many to Name);* (3) *One of the Final Settlers, Looking from Inlet End; Note Novel Weir Arrangement;* (4) *Rupp, Kaiser, Calvert, Moorehouse, Allton, Bradshaw*

GEORGE FLOWER, Sup't, Treatment Works, Cleveland, Ohio, reported that ferric-chloride and lime seemed the best combination for the Cleveland sludge also. In control they too had discarded the pH readings and resorted to alkalinity titrations of the filtrate and operator observations.

L. L. HEDGEPATH, Director of Technical Service, Penna. Salt Manufacturing Company, Philadelphia, Penna., in a written discussion agreed for the most part with Mr. Cameron's conclusions, but questioned such long mixing as used at Springfield. Trends had been to the short mix, in which two minutes seemed ample. It was his opinion that arrangements should be provided to be in a position to secure the optimum mix—somewhere between 2 and 10 minutes. To Allton and Sheets at the Columbus plant (1931), must go the credit for having evolved the scheme of moderate primary ferric-chloride and secondary heavy lime dosage for economy and maximum filter yields.

EDITORIAL

Corrosion Control: Art vs. Science

IN THIS issue there appears an article by Chas. P. Hoover which presents the findings resulting from a study of the corrosiveness of waters when treated by various methods. The results of these eminently practical studies, conducted at the Columbus (Ohio) Water Purification Plant, are anything but reassuring to chemists and water works managers who have been treating waters with lime for the purpose of correcting corrosion difficulties.

The Columbus findings indicate that correcting the corrosive properties of waters, through the addition of lime or other alkaline materials for the purpose of raising their pH value, is not as free from likelihood of deficiencies as is assumed by chemists and engineers, generally. One hears much concerning the assumption that a water treated to produce a calcium carbonate depositing tendency can not longer be a corrosive product, because of the protective coating which it is laying down continuously on the metal at the contact face. After this, it is assumed that over-treatment with lime, is undesirable only in respect to waste of chemical and a resultant excessive deposition of scale on pipes at points near to that of lime application. But, there has been no such definite proof of the fact that treatment must be held in defined limits, if corrosion of household piping and plumbing equipment is to be practically controlled, as that which is revealed in Mr. Hoover's article.

In looking over the analyses of the various waters, run through household hot-water heaters and tanks at Columbus in an every-day manner, the average water-works chemist would miss far in his surmise as to which type of treatment was the most effective—i.e., which water was the least productive of pitting and tuberculation. He would hardly be inclined to agree with anyone who might have contended that the partially softened water with 84 parts per million of hardness and no free carbon dioxide (pH 8.9) was to prove more corrosive than the water treated to contain no normal carbonates (pH 7.5) and a residual free carbon dioxide content to the extent of 7.0 parts per million. Yet, this is exactly what the findings have shown to be the case.

In each of the above waters the dissolved oxygen content was essentially the same, the average being 7.7 in the first and 7.8 in the second. To test the effect of dissolved oxygen a parallel test was run with partially deoxygenated water containing but 2.3 parts of dissolved oxygen in which a pH value of 9.0 (87 hardness) was maintained. Another upset to theory came when this water, with least oxygen, proved the second most corrosive in the series of the five treatments studied. The fourth water in the series was that treated with lime to produce a pH value of 10.1 (94 hardness). It proved the second least corrosive, but proved deposit forming to an excessive degree; and, the most pronounced in dissolving the zinc galvanizing.

Unfortunately, the Columbus hot water experiments do not disclose what would have been taking place simultaneously in the cold water service pipes, the meters, or the mains in the street. However, two very important lessons come from the findings during the first year of study; first, that there is ample need for further study of corrosion control by pH adjustment; second, the continuing need for considering materials of which mains, service pipes, household piping and plumbing appurtenances are constructed, when considering corrosion troubles and their cures. Mr. Hoover's article reveals, without much question, that pH control alone must be based on specific tests to reveal the actual suppression of corrosion and tuberculation. It is apparently insufficient that the water be proved a depositing water in respect to calcium carbonate, or that it will not dissolve calcium carbonate after treatment.

Once we knew an operator of a small filtration plant. He contended that adding lime to his plant's effluent caused an increase in complaints of "red-water." He had given some thought to the matter and had found what he considered the optimum treatment through the simple expedient of covering slightly rusted nails (sand papered lightly), with the product he was delivering through the rusted steel pipes (once galvanized without doubt) of his consumers. The water that caused the least attack on these nails, as indicated by iron rust stain on the glass walls of the test jars, was that used in establishing the most effective "treatment-pattern" in corrosion control. Another, we know, uses weighted bits of steel piano-wire with more refinement in evaluation, but the same net result to all practical intent insofar as plant operation and treatment control is concerned.

We wonder if, after all, such every-day methods as those employed in making the all-revealing corrosion studies at Columbus, and the control checks by wire-nail and piano-wire operators, are not the type of specific tests most needed in the "art" of corrosion control. Until chemists have more adequate and certain methods of corrosion control, by treatment alone, to offer or have evolved some more scientific control test than pH readings on the so-called marble test, it seems that the "art" of preventative treatment can be materially advanced by adhering to a specific but simple check test such as the rapidity and extent of the rusting of nails by the treated water.

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Banging Manhole Lids

ON AN extended trip by automobile this past Summer the number of banging man-hole lids passed over were particularly noticeable for some reason. Whether due to jangled nerves, or by coincidence, it seemed that every city or town driven through had one to several of these "bang-bang" lids in the main thoroughfares. In some cases the neighbors had imperfectly placed a protruding piece of tar-paper under the offending lid. Some seemed to have tar poured around the edges.

It is hardly conceivable that, for the sake of the few pennies saved per cover, municipal authorities will ignore the annoyance, if not the possible danger, to its residents and visitors; and, do nothing about a matter so simple and inexpensive as correcting the banging of loose man-hole lids. One practical remedy lies in the use of an adhesive cushion-tape which is applied as a fixed, but removable, gasket beneath the rim of the lid.

EQUIPMENT NEWS

Rex Triturator

Three hundred and fifty thousand blade cuts per minute—is a distinctive feature of the new screenings-shredder which Chain Belt Company of Milwaukee, Wis., has recently announced, following an exhaustive operating test development. Low power requirements is another stressed feature.

Taken out of the sewage on mechanical or hand-operated bar screens and put through the "Triturator" (intermittently at small plants, continuously at large works) sewage and garbage solids are returned to the sewage as a suspension of non-clogging, non-floating solids. From

Rex Triturator—Screenings Shredder

the "Triturator," located behind the bar screen, the effectively comminuted solids pass through pumps and plant as just a minor increment in sludge production.

The "Triturator," which is equipped with novel operating safety features, consists essentially of a high-speed rotor, set with readily renewable tool-steel cutting teeth. Passing between cross ribs of the so-called "grate" shearing action is produced at the rate of 350,000 cuts per minute. External gate-spring adjustment serves to produce the degree of comminution or "trituration" desired. The machine is in reality a combination shredder-cutter, for which the manufacturer claims that even turkish towels, bailing wire, and the like, hold no fear. In four sizes, with capacities ranging from 15 to 60 cubic feet of screenings per hour, the manufacturer stresses the moderate 3 to 10 H.P. motor drive provided.

Other features: A self-contained complete unit; which starts and operates with practically no vibration; low flush water requirements; accessible and easily kept clean; fool-proof operating safety appurtenances. For detailed information, with illustrations, a copy of the new bulletin, "Rex Triturators," should be requested from Chain Belt Company, (Dep't S.), Milwaukee, Wis.

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Thwing-Albert Portable pH. Meter

The Thwing-Albert Instrument Company of Philadelphia is offering a compact, and inexpensive portable (electrometer) pH meter, which we have recently seen in use.

With all electrodes and necessary chemicals contained in the one box, it is convenient to handle; and, seems to be exceedingly simple to operate. Readings are taken in pH units direct. Being potentiometric (dry cell operated) color, turbidity, density, etc., offer no interference with accuracy.

Model No. 1, pictured herewith is equipped with quinhydrone and antimony electrodes and has an effective range of pH 0 to 12. Model No. 2 (similar in appearance) is fitted with a vacuum tube

Model 1 Thwing-Albert Portable pH Meter

potentiometer which enables it to be employed also with glass electrodes, for use in oxidizing or reducing liquids such as are encountered in industrial waste problems. The apparatus seems to be rugged and is readily portable; considered inexpensive.

For descriptive literature, containing prices, address Thwing-Albert . Instrument Company, 3339 Lancaster Avenue, Philadelphia, Pa.

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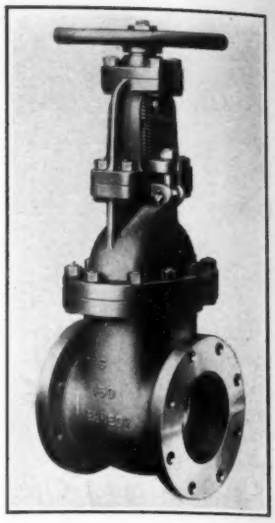
Improved Gate Valves

The Kennedy Valve Manufacturing Company announce a new line of Standard Iron-Body Wedge Type Gate-Valves which have several improved features.

The iron used in the oval section bodies (to increase strength) is stated to be particularly dense; thereby, 50 per cent stronger than ordinary cast-iron.



New Kennedy Gate Valve

There are no studs used. And, all bolts have the nut *above* the flanges, leaving ample room for wrench work. Both the non-rising stem and outside-screw-and-yoke types have special provisions to facilitate repacking. The latter (illustrated) has eye-bolts at the stuffing box, which swing out of the way; washer nuts, which eliminate loose washer annoyance; packing glands with slotted flange bolts; shelves on the inside of the yoke to hold the gland out of the way; rust-proofed stuffing box bolts and nuts; corrosion resistant heavy bronze bushings at yoke cap, packing gland and stuffing box.

The discs are reinforced with interior posts; are reversible and interchangeable, and are self-draining in any position. In both types of valves special provisions provide an assured stem alignment at all times.

Offered in all standard sizes, 1½ to 60 inch (with screw ends in many sizes) steam valves run to 150 lbs. pressure, water valves to 200 lbs. working pressure. For descriptive literature and further information, address The Kennedy Valve Manufacturing Company, Elmira, N. Y.

▼

Sparling Expansion

From R. W. Sparling, well known manufacturer of Sparling Main Line Meters, comes the announcement that with the rapid upturn in their business a new office has been opened in Cincinnati, Ohio, to serve territory not so readily reached from Sparling's New York or Chicago offices.

To their Chicago office has been added two men to take care of increased business. Victor J. Bernhard, for 20 years branch manager with Pacific Flush Tank Company in Los Angeles, has recently joined the Sparling organization. Also, a Traveling Service Department has been established under C. R. (Dick) Martina who has been for 12 years in the production and service end of the Sparling factory in Los Angeles. Both will work under Paul R. Kittinger, manager of the Chicago office, 3104 S. Michigan Avenue.

How does it compare with VICTOR-KIMBALL-KROGH?

Internationally Distributed

This is the question becoming more and more pertinent among discriminating pump purchasers. ¶This is the important question asked by pump-wise buyers. ¶It is the question logically resulting from over sixty years of dependable pump building—from indisputable evidence of the performance records of thousands of Victor-Kimball-Krogh Deep-Well Turbine Pumps. ¶It is the paramount question today when past depression years speak eloquently of the wastefulness of cheaply built depression products. ¶No pump will last to justify the purchase price nor guarantee enduring pump efficiency if it cannot measure up in workmanship and proved design-excellence with Victor-Kimball-Krogh Deep-Well Turbine Pumps. ¶This is not an idle boast, but a straight-forward statement of facts provable to any sincere investigator.

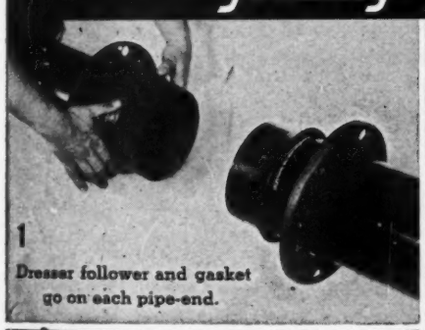
VICTOR EQUIPMENT COMPANY
KIMBALL-KROGH PUMP DIVISION

515 Harrison Street
SAN FRANCISCO

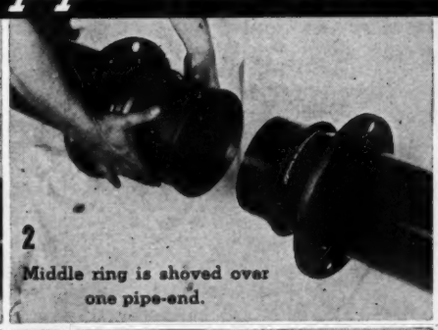
VICTOR KIMBALL KROGH

1010 E. 62d Street
LOS ANGELES

SO SIMPLE . . . YET SO *Tight!*
— *joining pipe with Dresser Couplings!*



1
Dresser follower and gasket go on each pipe-end.

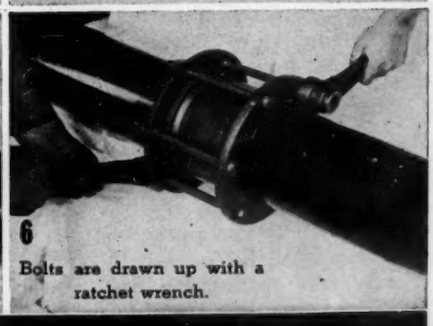


2
Middle ring is shoved over one pipe-end.

3
Other pipe-end is stabbed into middle ring.

4
Gaskets and followers are moved up against middle ring.

5
Bolts are inserted and nuts run up to finger tightness.



6
Bolts are drawn up with a ratchet wrench.

Result: *A flexible joint, absolutely tight.* Dresser Couplings are available for all kinds and sizes of plain-end pipe, from ⅜" to the largest diameter made. Write for descriptive folder No. 355.

S. R. DRESSER MANUFACTURING COMPANY • BRADFORD, PA.
IN CANADA: DRESSER MFG. COMPANY, LTD., 68 FRONT ST., W., TORONTO, ONT.

CATALOGS AND LITERATURE RECEIVED:

[Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.]

"The Columbian Line"—From Mueller Company of Decatur, Ill., and Chattanooga, Tenn., has come an excellently illustrated 48-page catalog (A-200) describing the "Columbian Line" of Hydrants, Valves, Valve Boxes, Drilling Machines, Tapping Valves and Sleeves. It tells why Columbian Hydrants are "15 steps ahead" and leaves no detail of construction or repair to the imagination. For ordering valves and hydrants or parts, and for installation and maintenance, instructions set forth are clear and valuable to Mueller-Columbian customers and others. Equal attention is given to gate valves of a variety of types; also, drilling and tapping machines, sleeves and sleeve-valves.

A companion catalog (A-100) covers the complete Mueller-Columbian line of Fire Protection Appliances, including F. M. Check Valves.

For Catalog A-200 and A-100 address Mueller Co., Decatur, Ill., or Chattanooga, Tenn.

"Aer-O-Mix"—From Vogt Manufacturing Co. of Louisville has come an illustrated folder describing the combined chemical mixing and aerating "Aeromix," which depends upon a sweeping-out air emulsion created by an air aspiration principle. Two types are described—the Gravity Type with free discharge and the Rotary Aeromix with submerged discharge—the latter being equipped with an impeller to create the circulation draught through the aspirator tube and produce recirculation. The aeromix is offered also as an economy producing recarbonating device for water softening —CO_2 direct from stack or stove being admitted where air ordinarily enters. The brochure is amply illustrated with typical installations. For a copy, address Vogt Manufacturing Co., P. O. Box 1122, Louisville, Ky.

"Kimballectric Centrifugals"—From Victor Equipment Company of San Francisco a bulletin describing the compact "Kimballectric" Centrifugal Pumps, of horizontal type. Type "KE" comes in sizes from ¾ to 2½ inch (10 to 350 g.p.m.); Type "L.K.E." in larger capacities. For "Kimballectric" Bulletin 116, address Victor Equipment Company (Pump Division), 515 Harrison Street, San Francisco.

"Sludge Bed Enclosures"—Lord and Burnham Company are distributing an "Engineers' Service Sheet" which contains detail drawings of typical L. & B. Glass Enclosures for sludge-beds. Sludge bed design and suggested specifications covering glass enclosures are the two features of the brochure.

For "Engineers' Service Sheet No. 124-A," address, Lord and Burnham, Irvington, N. Y.

"CO_2 Meters"—Is an illustrated bulletin and data book containing descriptions and specifications covering Republic CO_2 Meters, both as to construction and principles of operation. In it are technical chapters on "Perfect Combustion" and "Causes of Insufficient Combustion." Described and illustrated are the several Republic Meters used in detecting the imperfect, and maintaining the perfect, combustion. For "CO_2 Meter Data Book No. 403," address Republic Flow Meter Company, 2240 Diversey Parkway, Chicago.

"Reeves Automatic Control":—Is a 12-page booklet just issued by Reeves Pulley Company, for 35 years producers of speed control equipment. With ample illustrations the text sets forth methods of automatic speed regulation, feeding of pulverized materials such as coal to stokers and chemicals to water and sewage, through the use of one or another of four types of Reeves Controls and Reeves Variable Speed Transmission units. With one unit, boiler steam pressure is maintained by control of fuel feeding rates to meet changing loads. With another, chemical feed in sewage treatment is kept apace automatically with flow changes through differential head meters. Another, maintains a balance between sludge input, rates of mechanical filtration, and speed of the revolving fifth drum. Still another controls rates of sludge feed to a mechanical dryer. For a copy of the suggestive "Automatic Production Control" address Reeves Pulley Company, Columbus, Ind.

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of March 3, 1933

Of Water Works and Sewerage, published monthly at Chicago, Illinois, for October 1, 1936.

State of Illinois, County of Cook—ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared E. S. Gillette, who, having been duly sworn according to law, deposes and says that he is the business manager of the Water Works and Sewerage, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Gillette Publishing Company, 400 W. Madison St., Chicago, Ill.

Editor, L. H. Enslow, 155 E. 44th St., New York, N. Y.

Managing Editor, C. T. Murray, 400 W. Madison St., Chicago, Ill.

Business Manager, E. S. Gillette, 400 W. Madison St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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Mrs. R. W. Hume, 303 S. Stone Ave., La Grange, Ill.
H. P. Gillette, 400 W. Madison St., Chicago, Ill.
E. S. Gillette, 400 W. Madison St., Chicago, Ill.
Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.
Provident Trust Company, 17th and Chestnut Sts., Philadelphia, Pa.
Louise Forsythe, 13 E. Windemere Terr., Lansdowne, Pa.
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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is —. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1936.

(Seal)

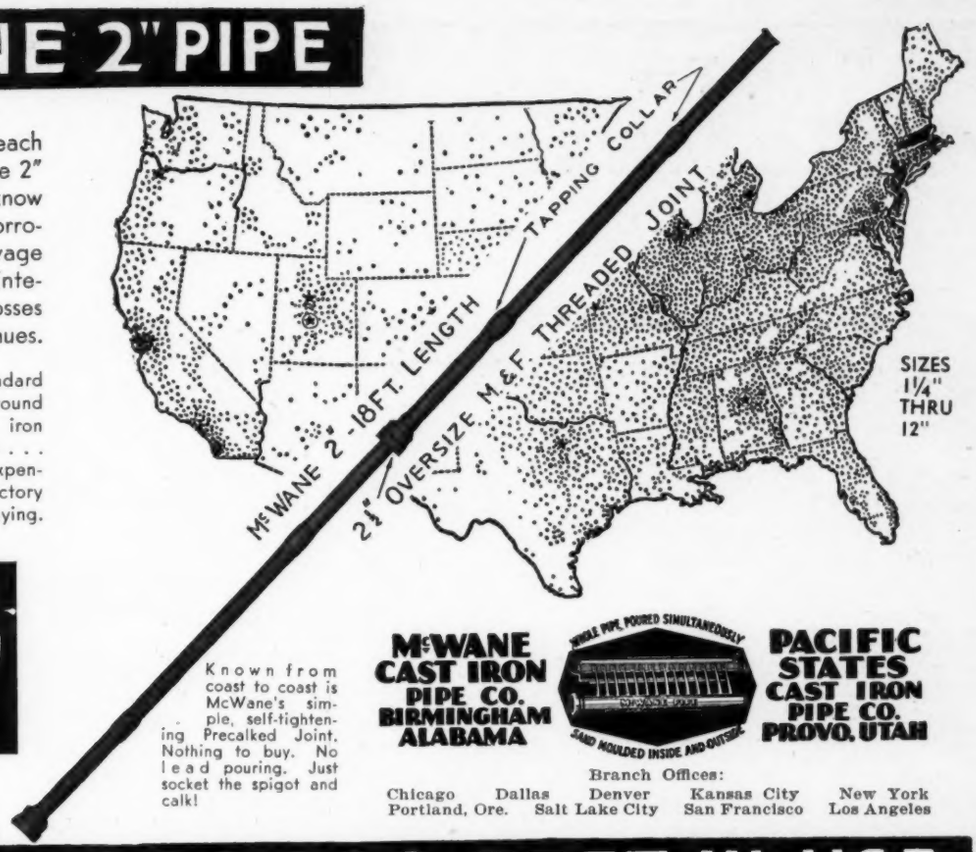
KITTIE C. WOULFEY,
Notary Public.

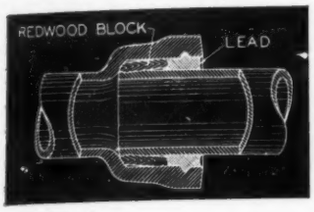
(My commission expires Feb. 8th, 1938.)

McWANE 2" PIPE

Coast to coast . . . each dot is a user of McWane 2" Cast Iron Pipe. They know Cast Iron Pipe resists corrosion . . . has high salvage value . . . reduces maintenance . . . saves water losses . . . and increases revenues.

Cast Iron Pipe is the standard for all sizes of underground mains. McWane 2" cast iron pipe comes in 18 ft. lengths . . . tapping collars eliminate expensive strap saddles . . . factory made joints permit easy relaying.





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Known from coast to coast is McWane's simple, self-tightening Precalked Joint. Nothing to buy. No lead pouring. Just socket the spigot and calk!

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for Modern Sewage Disposal Plants

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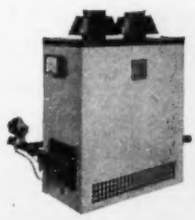


Model 4-GA
Eight to thirteen sections.

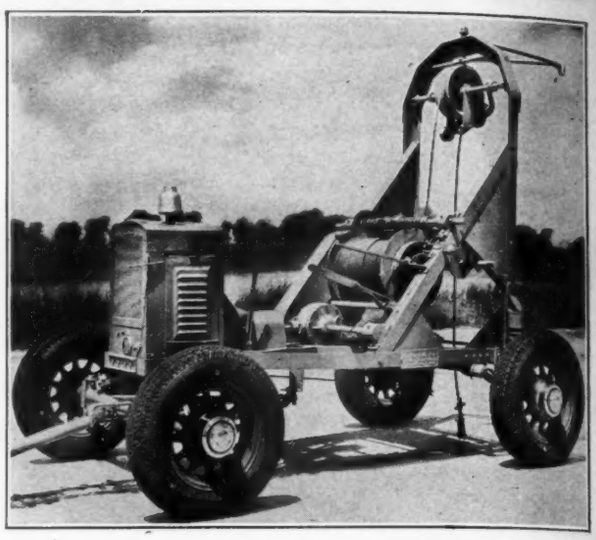
AMERICAN GAS PRODUCTS CORPORATION
DIVISION OF AMERICAN RADIATOR COMPANY
40 WEST 40TH STREET · NEW YORK, N.Y.

For "BLACK WATER" Trouble

Nothing brings in the complaints faster than "black water" trouble or "red water" trouble. These problems, caused by manganese or iron, can be solved by using Ferrisul as a coagulant. The quick-forming, rapid-settling Ferrisul floc is not soluble at the high pHs necessary in treating such waters. Write for new Ferrisul booklet, or consult us about your specific problems. MERRIMAC CHEMICAL CO., Everett Station, Boston, Mass. (*A subsidiary of* MONSANTO CHEMICAL CO.)

Ferrisul
FOR WATER AND SEWAGE TREATMENT

SEWER CLEANERS



O.K. Champion Sewer Cleaners have passed their 25th year of satisfactory performance. We now make three sizes—Junior—Standard and Power Cleaners. Hundreds of O K Champion Cleaners are in use in 42 States and Canada.

The Power Cleaner illustrated above is working to the entire satisfaction of the purchasers in Atlantic City, N. J., Little Rock, Ark., and others.

We solicit your inquiries for literature and prices. Deliveries can be made promptly.

CHAMPION CORPORATION
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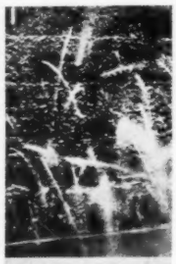
WATER-PROOFING

with

Sika



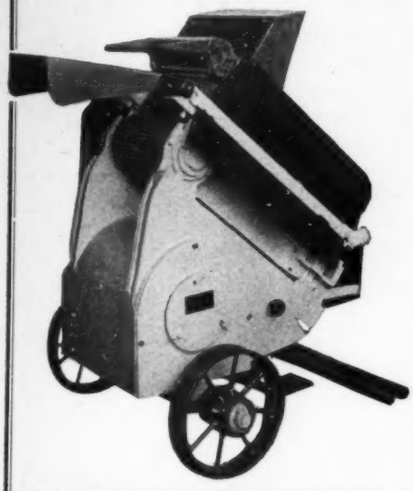
1 Original surface hacked.
2 Water concentrated to enlarged bleeder holes by Sika #4A.
3 Two bleeder holes plugged by Sika #2. Infiltrations concentrated to bleeders.
4 Inserting Sika #2 into last bleeder hole.
5 All bleeder holes plugged with Sika #2, and trimmed to contour.
6 Protective coat of Sika #2 cement plaster applied.

Use Sika
to stop water inflow through any masonry. Sika mixed with portland cement easily applied by hand — seals off infiltration from underground streams even under pressure.

Write us about your problems

Sika, Inc.
1943 Grand Central Terminal, N. Y. City

"THE GREATEST LITTLE MACHINE I ever saw. I could not believe that it would grind so much sludge UNTIL I SAW IT WORK," reports one user of the ROYER SLUDGE DISINTEGRATOR. Made in 4 sizes with either electric or gasoline engine drive.



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"More Than 4,500,000,000 Gallons Per Day Pass Through

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Simplicity of Design, Accuracy, Dependability, Low Maintenance Cost, and Direct-Acting Features make SIMPLEX CONTROLLERS the selection of Designing and Operating Engineers all over the world.

YOU can better YOUR filter operation by their use.

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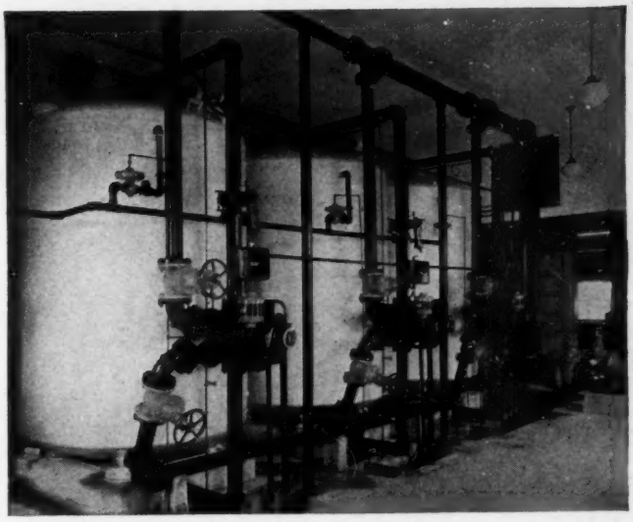

Permutit Fully Automatic Zeolite Water Softening Equipment in Municipal Plant, City of Somerset, Pa.

Soft Water as You Want It . . . *Automatically!*

The Permutit municipal water softening installation at Somerset, Pa., shown above, is set to supply an effluent of 2 grains hardness. The raw water is 10 grains hard and 8 grains of hardness are removed, with all the iron. The same equipment can be readily adjusted to remove only 5 grains of hardness — or any other fraction of the whole.

This flexibility is characteristic of Permutit Zeolite Water Softening plants. And automatic operation assures maximum efficiency with minimum attendance. Municipal executives, engineers, and consultants will find much interesting data applying to current municipal water softening problems and practice in Permutit Municipal Water Softening Bulletins. Write for copies. Address the Permutit Company, Dept. G1, 330 West 42nd Street, New York, N. Y.

Permutit
Water Conditioning

L.F.C.

HIGHEST QUALITY CASTINGS PLUS

60x42x42

QUICK DELIVERIES

—spell economy on any job!—For more than 50 years "Lynchburg" has been famed for it's high quality castings, and it's unusually quick deliveries—Many so-called "Specials" in other foundries are every day routine at "Lynchburg."—"Lynchburg Service" insures you against expensive delays.

Bell and Spigot Pipe and Fittings
From 4" to 54"
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The Infilco Equipped Water Purification Plant Centralizes Equipment Responsibility and Assures Coordinated Results

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INFILCO INTERNATIONAL

ANTHRAFILT SAVES $160,000

ARTHUR T. COOK, General Superintendent and Engineer, Passaic Valley Water Commission, Paterson, N. J., states in an article in Waterworks Engineering, September 16, 1936:

"It can be safely said that the use of Anthrafilt has saved us an investment of approximately $160,000, which would have been required to increase our pressure filter plant to the required capacity using sand beds at a rate of 0.6 to 0.8 m.g.d. per tank."

A reprint of this article will be mailed Engineers and Executives requesting same.

THE HUDSON COAL CO.
SCRANTON, PA.

G. B. FILLMORE
General Sales Agent

LACKAWANNA "The D&H" ANTHRACITE

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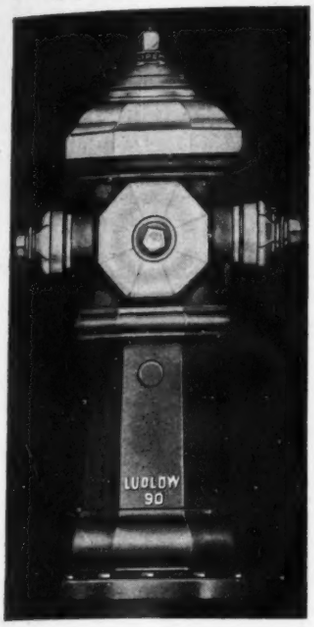
Asst. Gen. Sales Agent

The Verdict— *in* PEOPLE *vs.* FIRE



In thousands of cities and towns, Ludlow Hydrants have won approval for action against fire — for their easy maintenance — for their beautiful outside symmetry.

Strong-points of Ludlow design and manufacture include: Water way free of obstruction. All working parts easily removed. Bottom drain eliminates freezing. No surging or water hammer. Break above ground in accidents. Replaceable without digging. *Send for folder.*

The LUDLOW VALVE MFG. CO.
TROY, NEW YORK

THE BILTMORE HOTEL
Los Angeles, California

Located Downtown

1500 ROOMS
Clerks on Every Floor

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Sensible Prices:
Singles ....$3.50 up
Doubles ...$5.00 up

Visit the
RENDEZVOUS
A Night Club in the Afternoon
and the
FAMOUS BILTMORE BOWL
Two Floor Shows Nightly

●

Excellent Service Exceptional Cuisine

The Biltmore has facilities for your every need.

They wont balance because of "S-O"

SEWER ODORS creep in *everywhere*—and sooner or later they show up in the community finances... all because of hydrogen sulphide, the obnoxious gas generated by sewage bacteria. When the gas escapes, the voters complain. When it stays in sewer lines it generates sulphuric acid—and that's where trouble begins.

The acid attacks the lime in the mortar and cement of sewer walls. Before long the whole sewer may be gone. This has actually happened in more than one California community, even before the sewers were paid for!

But you can avoid "S-O" and the danger to sewer lines, by chlorinating the sewage with Bear Brand Chlorine, as a score of other California communities are doing. Chlorine neutralizes the existing gas before it can form acid, and kills the sewage bacteria which generate the gas. No more odors, no more danger.

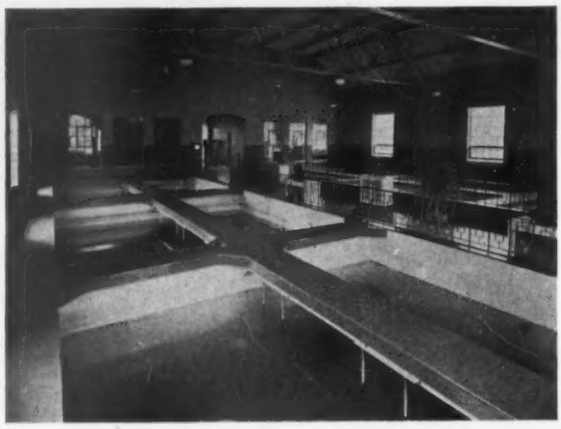
Both initial cost and upkeep of chlorinating equipment are low. And chlorination may save on sewage treatment plant operating costs, because chlorination often increases plant efficiency. This means faster treatment, increased plant capacity... Why not talk to our sanitary engineers about sewage treatment with Bear Brand Chlorine? No charge or obligation.

Send for "Use of Chemicals in Sewage Treatment": We'll be glad to send you, without charge, a reprint of this article by R. A. Stevenson, telling how chemicals are used in successful treatment of sewage.

Liquid Chlorine • Ammonia • Ferric Chloride

GREAT WESTERN ELECTRO-CHEMICAL CO.

9 MAIN STREET, SAN FRANCISCO
PLANT: PITTSBURG, CALIFORNIA
4151 BANDINI BLVD., LOS ANGELES



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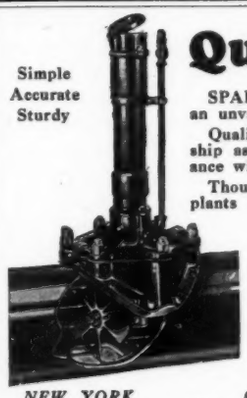

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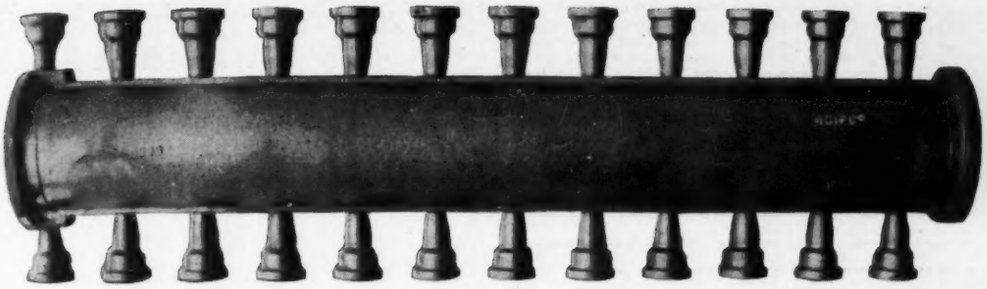

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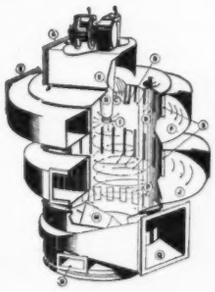

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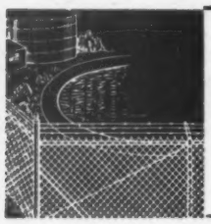

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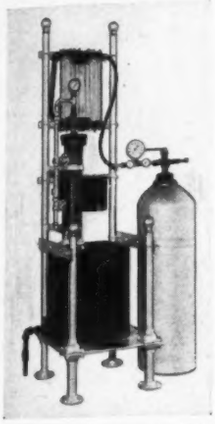

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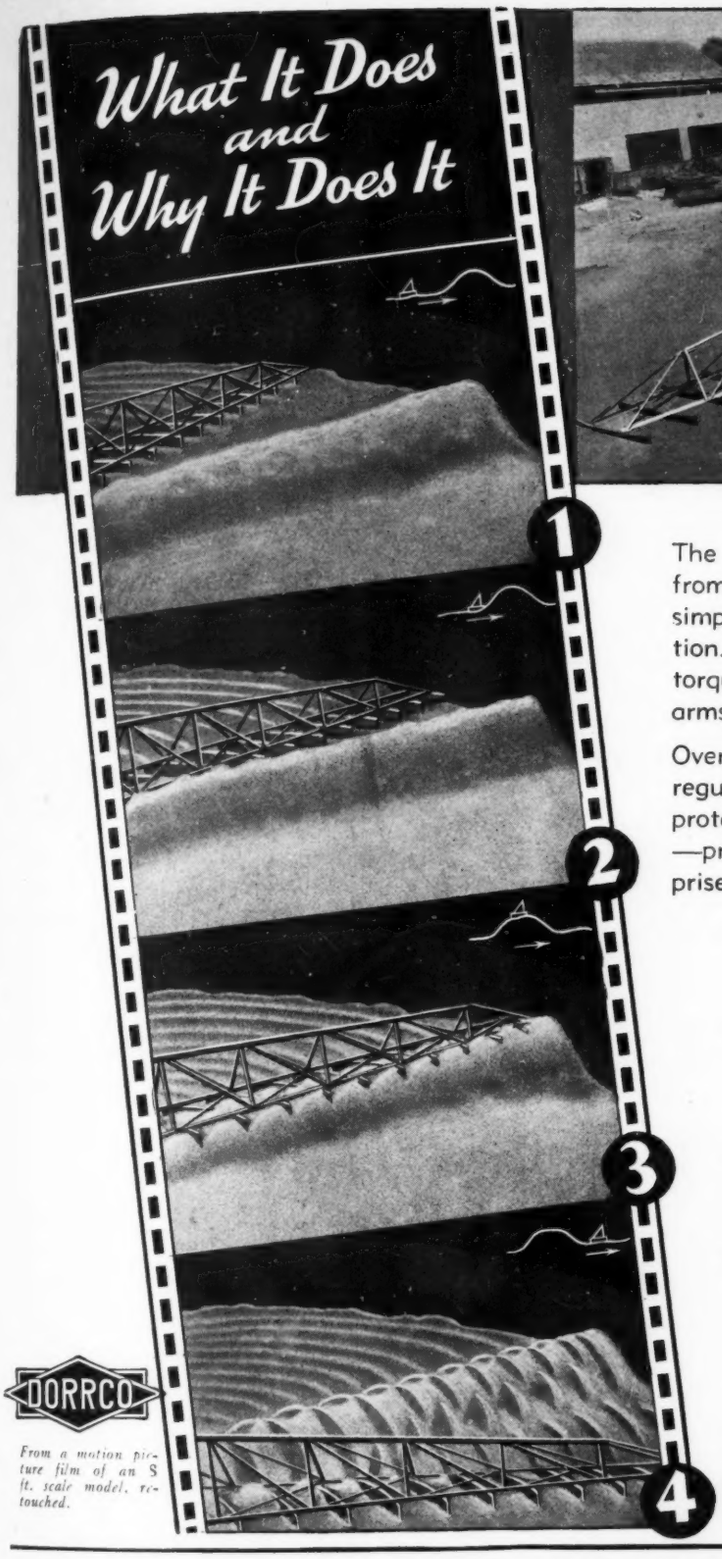
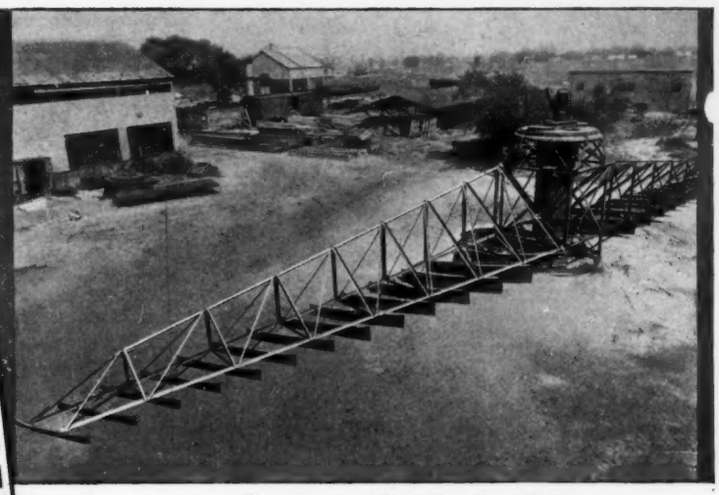


From a motion picture film of an 8 ft. scale model, retouched.



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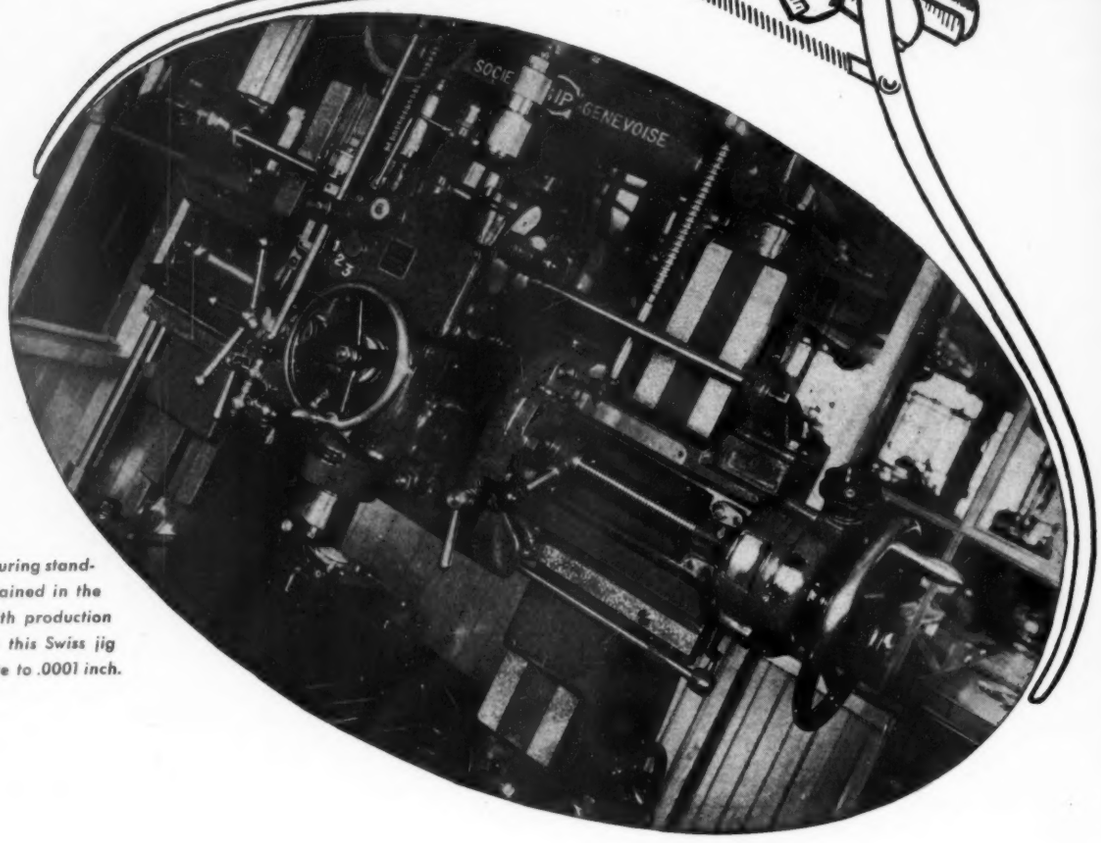

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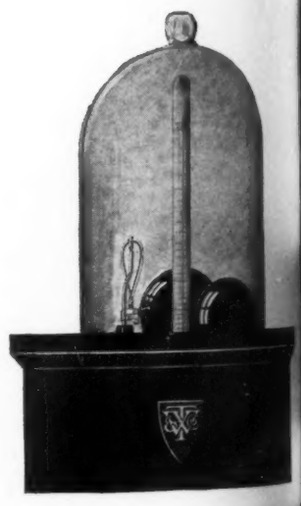
Ask for technical publications 38, 157, and 158



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